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City of Cambridge.

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THE FIRST REPORT 32020

OF THE

AMBRIDGE WATER BOARD

TO

THE CITY COUNCIL;

TOGETHER WITH THE

REPORT OF THE SUPERINTENDENT FOR 1865.



NEW YORK  
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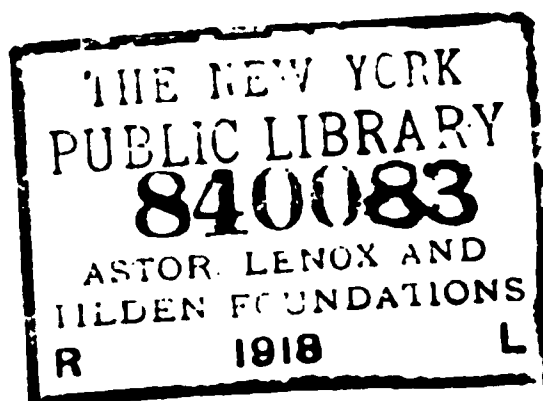
CAMBRIDGE:

JOHN WILSON AND SON.

University Press.

1890.

★ CAMBRIDGE PUB. LBRY



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R E P O R T  
OF  
THE CAMBRIDGE WATER BOARD.

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CAMBRIDGE, Dec. 8, 1865.

IN accordance with the requirement of the "Ordinance providing for the care and management of the Cambridge Water Works," the Cambridge Water Board would respectfully present their first Report.

The Cambridge Water Works came into possession of the City by purchase on the 28th of April of the present year, and continued, by vote of the City Council, in the care of the Mayor until the organization of this Board on the 9th of June, 1865.

The purchase included all the real and personal property of the Cambridge Water Works, with the exception of the sinking fund which had been provided for the ultimate payment of the bonds of the Company, and included cash and claims due the Company in the hands of the Superintendent to the amount of one thousand four hundred and eleven dollars and ninety-five cents, which deducted from the sum paid by agreement, two hundred and ninety-one thousand four hundred and eighty dollars, makes a cost of two hundred and ninety thousand and sixty-eight dollars and five cents. To this should be added two hundred and ninety-one dollars and fifty cents, the amount due to sundry persons for street mains put in by them and payable in water, making a grand total of two hundred and ninety thousand three hundred and fifty-nine dollars and sixty cents.

As soon as this Board was organized, Mr. George W. Fifield was appointed Superintendent; and his Report to the Board is herewith transmitted.



Justin A. Jacobs, Esq., was elected Clerk of the Board; and Thomas G. Bruce, for many years the capable and efficient engineer of the Water Works, was appointed Engineer of the Pumping Engines; and Calvin C. Smith, Foreman of the Works. A code of By-laws was adopted, and the Board proceeded to examine the works to ascertain their condition and what was necessary to put them in good working order. It was found that the well-room at the pond had been injured by the ice, and needed renewal, which was ordered; and a substantial granite structure has been put in the place of the imperfect and decayed one. The roof of the Engine-house was repainted, the reservoir emptied and thoroughly cleansed, and a new outlet for future extensions of the works was put in. The attention of the Board was next directed to the enlargement and extension of the works to meet the growing demands of the citizens. The capacity of the reservoir was only enough, if full, to supply, when not pumping, the consumption for not more than two or three days; and in case of a serious accident to the pumps, or the pipe between the pumps and reservoir, the city was liable to be left without water. The original purchase included a piece of land at the side of the reservoir, and this has been enlarged by the purchase from C. C. Little, Esq., of a small strip, which will enable the Board to erect an additional reservoir, to contain, with the old one raised five feet higher, six million gallons.

The cutbankment for the new reservoir has already been thrown up; and the Board will be ready in the spring, if the means are furnished by the City Council, to push forward the work for an early completion.

Since the purchase some considerable leaks and obstructions in the pipes have been discovered and remedied, since when a considerable improvement in the head and supply in all parts of the city has been noticeable.

The Board believe the works, including the street-mains, are now in good order.

When the new reservoir is completed, and the head of water increased by five feet, we shall be able to furnish a somewhat larger quantity of water; but the present means for its conveyance are altogether inadequate, and at an early day the Board

will present to the City Council a plan for the enlargement of the works, with estimates of cost, etc. We believe that the increased income which an abundant supply of water would command would fully pay the interest on the cost, the additional expenses, and the sum required by the Act to be paid to the sinking fund each year.

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CITY OF CAMBRIDGE.

IN COMMON COUNCIL, Dec. 13, 1865.

Accepted and ordered to be printed with the next City Documents.

Sent up for concurrence.      Attest:

JOS. G. HOLT, *Clerk.*

IN BOARD OF ALDERMEN, Dec. 13, 1865.

Concurred.

Attest:

JUSTIN A. JACOBS, *City Clerk.*

# REPORT

OF

## THE SUPERINTENDENT OF THE WATER WORKS.

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OFFICE OF THE WATER WORKS, CITY HALL,  
Dec. 6, 1865.

*To the Cambridge Water Board:*

GENTLEMEN, — In compliance with the ninth section of the Ordinance providing for the care and management of the Cambridge Water Works, I herewith submit my first annual Report: —

The works were purchased and came into the possession of the City on the twenty-eighth day of April last, at a cost of two hundred and ninety-one thousand four hundred and eighty dollars . . . . .	\$291,480.00
Less cash assets in hands of Superintendent, April 28, 1865, since paid into the Treasury . . . . .	1,411.95
	\$290,068.05

Since which time a new and substantial granite well-room has been built at the pond, with other improvements there, costing . . . . .	1,338.13
A new outlet has been laid at the reservoir, at a cost of	1,694.72
New main pipe has been laid in a part of Magazine, Webster, William, and Pearl Streets, at a cost of	862.03
A strip of land has been purchased, to enlarge the reservoir lot, costing . . . . .	800.00
Paid on main pipe previously laid . . . . .	125.98
Interest due and payable on the original purchase to Dec. 1, 1865 . . . . .	7,062.79
Making the cost of the works at this time . . . . .	\$301,951.70

The works, as the Board are aware, are not of sufficient capacity to supply the present consumers properly; and the question is for you to decide whether we shall continue to increase the number of consumers without an increase in the quantity of water. It would seem that early provision should be made for an ample supply of water for the whole city. The citizens generally are desirous of being supplied; and I have no doubt that any reasonable expenditure for that purpose will receive the approbation of the people, and increase the receipts accordingly.

The works are generally in good condition. Various repairs and improvements have been made during the season, which it is believed will both improve the quality and increase the quantity of the water.

### Receipts.

Received for water to Dec. 1, 1865 . . . . . \$32,367.19  
Expense chargeable to the above: —

Superintendent's salary . . . . .	\$625.00	
Clerk's salary . . . . .	250.00	
Engineer's salary . . . . .	566.68	
Office expenses . . . . .	277.55	
Repairs . . . . .	418.30	
Pumping account . . . . .	5,010.56	
Water rates refunded . . . . .	48.49	
	<hr/>	7,196.58

Balance in favor of works . . . . . \$25,170.61

The pumping account, which is made to include repairs upon machinery and all ordinary expenses at the pond, except the engineer's salary, is unusually large, from the fact that there was no fuel on hand at the time the City purchased the works, and now we have nearly a year's supply.

The coal used from May to October was such as the market afforded, not always of the best quality.

It will be borne in mind that the City have had possession of the works but little more than half a year; and although the water rates became due and were payable for a year in advance

within that time, still the receipts do not exhibit a full year's income, as many of our larger takers pay either quarterly or semi-annually.

It is estimated that a full year's receipts for water would amount to . . . . .	\$36,000.00
And if no alteration is made in the water rates, it is estimated that the sum to be assessed in July, 1866, will amount to . . . . .	38,000.00

which sum I have no doubt can be doubled within two years, if the City make early provision for supplying the water.

Number of abatements for a short supply of water, 52 ; amounting to . . . . .	\$313.50
For vacancy, 33 ; amounting to . . . . .	144.13

Water cut off from supply pipes 27 times.

Water let on to supply pipes 27 times.

The past season has been remarkably dry, and the pond has been lower than at any other time since the works were started. In consequence of the drought there has been a very free use of water, particularly in watering gardens, and it is worth considering whether there should not be some limit to such use of water.

In my judgment, the Ordinance providing for the care of the works needs revision, and I would ask your attention to the same.

The pumping engine, which has been in use since February last, is now laid off, and will doubtless require some repairs. The machinery otherwise is in good condition.

	Gallons.
Average number of gallons of water pumped daily since May 1 . . . . .	974,032
Average number of gallons pumped to reservoir for each hundred pounds of coal burned . . . . .	60,125
Average daily increased consumption over the corresponding months of last year . . . . .	32,417
Average daily consumption for each taker . . . . .	331

Supply account since April 28, 1865 :—

Expended for labor and stock . . . . .	\$5,230.45
Cash received on above account . . . . .	3,826.34
	<hr/>
Balance against the account . . . . .	\$1,404.11

There is due on the above account \$3,627.01.

Total cash receipts from all sources from April 28, 1865, to Dec. 1, 1865 . . . . .	\$37,605.48
Paid the City Treasurer . . . . .	37,605.48

### Recapitulation.

Net cost of works, April 28, 1865 . . . . .	\$290,068.05
Since expended . . . . .	11,883.65
Excess of expense over income on supply account . .	1,404.11
	<hr/>
Aggregate cost of works, Dec. 1, 1865 . . . . .	\$303,355.81
Deduct income from water above expenditure to Dec. 1, 1865 . . . . .	25,170.61
	<hr/>
Net cost of works to Dec. 1, 1865, income being deducted	\$278,185.20

Appended to this Report is a list of all the main pipe now laid, the streets through which it is laid, its size, length, etc.; also all the gates, stop-cocks, waste-gates, and blow-off pipes.

Respectfully submitted,

GEORGE W. FIFIELD, *Superintendent.*



## LOCATION OF MAIN PIPES.

STREETS.	Size Inches.	Length Feet.
From Engine-House into the Pond . . . . .	20	288
Duplicate . . . . .	20	18
From Engine-House to the Reservoir . . . . .	12	2,300
From the Reservoir through Brattle to Mason . . . . .	12	3,650
From the Reservoir, new outlet . . . . .	24	63
Brattle, from Mason to Harvard Square . . . . .	10	11,780
Harvard, from Harvard Square to Main . . . . .	10	
Main, from Harvard to Putnam . . . . .	10	
Mason, from Brattle to Garden . . . . .	10	
Garden, from Mason to Cambridge . . . . .	10	
Cambridge, from Garden to Columbia . . . . .	10	400
Prospect, from Cambridge to Somerville line . . . . .	10	
Prospect, from Somerville line to Glass Works (Cement)	10	
Main, from Putnam to Magazine . . . . .	8	3,000
Cambridge, from Columbia to Fifth . . . . .	8	3,000
Main, from Magazine to Car Factory . . . . .	6	2,600
Harvard, from Main to Hancock . . . . .	6	2,500
Cambridge, from Fifth to Bridge . . . . .	6	2,000
Garden and Waterhouse, from Mason to North Avenue	6	800
North Avenue, from Waterhouse to Sacramento . . . . .	6	1,765
North Avenue, from Sacramento to Holmes Chapel . . . . .	6	1,500
Sacramento, from North Avenue to Bleachery (Cement)	6	3,790

The other pipes, mostly three and four inch, are distributed as follows: —

### DISTRICT No. 1.

	Size Inches.	Length Feet.
Appleton, from Brattle, north . . . . .	3	878
Ash, from Brattle to Gas Works . . . . .	4	1,250
Brighton, from Brattle to Planing Mill . . . . .	4	969
Buckingham, from Craigie, north . . . . .	3	640

	Size : Inches.	Length : Feet.
Craigie, from Brattle to Buckingham . . . . .	4	352
Dunster, from Harvard Square, south (Cement) . . . .	4	300
Green, from Putnam, east . . . . .	4	120
Harvard Square to Church . . . . .	3	332
Holyoke Place, from Holyoke . . . . .	3	220
Holyoke, from South to Harvard . . . . .	4	709
Irving, from Cambridge, north (Cement) . . . . .	4	321
Irving, thence to Kirkland , . . . .	3	515
Kirkland, from Cambridge to Sumner . . . . .	4	1,436
Kirkland, from Irving, west . . . . .	3	570
Linden, from Harvard, south . . . . .	3	172
Mt. Auburn, from Ash, east . . . . .	4	769
Mt. Auburn, from Holyoke, east . . . . .	4	1,039
Mellen, from North Avenue, east . . . . .	3	480
North Avenue, from Holmes Chapel to the Bridge (Cement) . . . . .	4	540
North Avenue, from the Bridge to the Railroad Stable	4	200
Oxford, from Kirkland, north . . . . .	4	600
Phillips Place and Berkeley, from Mason . . . . .	4	1,607
Palmer, from Brattle to Church . . . . .	4	1,378
Putnam, from Main (Cement) . . . . .	4	597
Putnam, continued . . . . .	4	388
Quincy, from Harvard, north . . . . .	3	982
Remington, from Main . . . . .	3	234
School Court, from Brattle . . . . .	3	200
South, from Brighton to Holyoke . . . . .	4	553
Sumner, from Kirkland, south . . . . .	4	420
Trowbridge, from Harvard, north . . . . .	3	308
Ware, from Harvard, north . . . . .	3	300

## DISTRICT No. 2.

	Size : Inches.	Length : Feet.
Auburn, from River, east . . . . .	4	567
Auburn, from Pearl, east . . . . .	3	80
Austin, from Inman, east . . . . .	3	236
Austin, from Columbia, west . . . . .	3	508
Allston, from Pearl, east . . . . .	3	178
Broadway, from Moore to Hampshire . . . . .	4	800
Broadway, from Columbia, east . . . . .	3	312
Broadway, from Pioneer to Skinner's Wharf . . . .	3	901
Broadway, from Dana, east . . . . .	3	491

	Size Inches.	Length Feet.
Bristol, from Market, north . . . . .	3	250
Brookline, from Main, south . . . . .	4	1,828
Clark, from Washington to Chaney's factory . . . . .	4	500
Clark, from Hampshire, north . . . . .	3	234
Cherry, from Main to Harvard . . . . .	4	1,150
Columbia, from Main to Washington . . . . .	4	775
Columbia, from Washington to Worcester . . . . .	3	397
Columbia, from Harvard to Worcester . . . . .	4	252
Columbia, from Harvard, north . . . . .	3	600
Columbia, from Cambridge, north . . . . .	3	598
Passage-way from Bristol and Clark . . . . .	3	224
Clinton, from Main, north . . . . .	3	578
Kinnaird, from River, west . . . . .	3	153
Dana, from Harvard to Broadway . . . . .	3	616
Dana, from Harvard, south . . . . .	4	196
Davis, from Harvard to Broadway . . . . .	4	400
Distillhouse, from Cambridge, north . . . . .	3	706
Erie, from Pearl to Magazine . . . . .	4	500
Erie, from Pearl, east . . . . .	3	256
Essex, from Harvard, south . . . . .	3	1,036
Elm, from Hampshire, north . . . . .	3	225
Ellsworth Avenue, from Broadway, north . . . . .	3	920
Fayette, from Cambridge, south . . . . .	3	1,273
Front, from Main, east . . . . .	4	400
Franklin, from Brookline to Pearl . . . . .	4	457
Franklin, from Brookline, east . . . . .	3	108
Harvard, from Hancock to Davis . . . . .	4	4,050
Harvard, from Davis to Pioneer . . . . .	4	2,180
Harvard, from Cherry to Boardman . . . . .	3	100
Hastings, from Moore, east . . . . .	4	800
Hampshire, from Prospect to Columbia . . . . .	4	1,060
Hampshire, from Prospect, west . . . . .	4	193
Hampshire, from Clark, east . . . . .	3	143
Inman, from Main, north . . . . .	3	557
Inman, from Cambridge, south . . . . .	3	697
Jay, from Western avenue, west . . . . .	3	323
Lee, from Main, north . . . . .	4	397
Livermore, from Lincoln, south . . . . .	3	717
Lincoln, from Windsor, west . . . . .	4	290
Market, from Union to Bristol . . . . .	4	550
Market, from Union, west . . . . .	3	84

	Size : Inches.	Length : Feet.
Maple Avenue, from Cambridge, south . . . . .	3	1,111
Magazine, from Erie, south . . . . .	4	187
Magazine, continued south . . . . .	3	412
Magazine Court, from Magazine, west . . . . .	3	480
Magazine, from Erie, north . . . . .	6	846½
From Main to Osborn's mill . . . . .	4	492
Moore, from Harvard to Hastings . . . . .	4	225
Norfolk, from Hampshire, south . . . . .	4	783
Norfolk, continued south . . . . .	3	120
Norfolk, from Main, north . . . . .	3	1,250
Norfolk, from Cambridge, north . . . . .	3	639
Pearl, from Franklin, south . . . . .	4	2,174
Pleasant, from Main, south . . . . .	4	188
Pearl, from Franklin, north . . . . .	4	154
Pine, from School, north . . . . .	3	180
Pioneer, from Main to Broadway . . . . .	3	280
Prospect, from Main to Hampshire . . . . .	4	2,790
River, from Main to Fremont . . . . .	4	2,530
River, from Fremont to Riverside (Cement) . . . . .	4	560
River, to Riverside (part Cement) . . . . .	4	175
School, from near Pine to Windsor . . . . .	4	400
School, from Windsor nearly to Main . . . . .	4	919
Soden, from Western Avenue, west . . . . .	3	253
Temple, from Main, north . . . . .	3	190
Tremont, from Hampshire, south . . . . .	3	1,050
Tremont, from Cambridge, north . . . . .	3	171
Watson, from Pearl to Brookline . . . . .	3	522
Western Avenue, from Auburn to Howard . . . . .	4	927
Webster Avenue, from Somerville line, south . . . . .	3	170
Worcester, from Columbia to Norfolk . . . . .	3	444
William, from River, east . . . . .	3	647
Windsor, from Main to School . . . . .	4	250
Windsor, from Cambridge, south . . . . .	4	1,909
Windsor, from Cambridge, north . . . . .	3	362
Windsor, from Harvard to Market . . . . .	4	597
Washington, from Columbia, east . . . . .	4	2,200
Washington, from Columbia, west . . . . .	3	155
Webster, from Magazine, west . . . . .	4	295
Valentine, from Brookline, west . . . . .	3	240
Village, from Front, north . . . . .	3	353

## DISTRICT NO. 3.

	Size Inches	Length Feet
Bridge, from Craigie's Bridge to Somerville . . . . .	4	3,369
Charles, from Third, west . . . . .	3	230
East, from North to Hall's Wharf . . . . .	4	250
Fourth, from Cambridge to Spring . . . . .	4	898
Fourth, from Bridge, south . . . . .	4	149
Fifth, from Thorndike, south (Cement) . . . . .	4	105
Fifth, from Cambridge to Winter . . . . .	4	450
Fifth, from Otis, north . . . . .	3	100
Fifth, from Otis, south . . . . .	3	75
Gore, from Lambert to Fourth . . . . .	4	1,460
Leighton Court, from East . . . . .	4	150
North Street, from Water to East . . . . .	4	775
Otis, from Third to Fourth . . . . .	4	434
Otis, from Seventh to Fifth . . . . .	4	675
Otis, from Fifth, east . . . . .	3	300
Otis, from Second to First . . . . .	4	493
Second, from Cambridge to Jail . . . . .	4	506
Seventh, from Cambridge to Thorndike (Cement) . . . . .	4	528
Sixth, from Otis, north . . . . .	3	181
Sixth, from Thorndike, south . . . . .	4	245
Short, from North, south . . . . .	3	180
Seventh, from Thorndike, south . . . . .	3	135
Second, from Cambridge, north . . . . .	3	200
Spring, from Third, west . . . . .	3	1,578
Thorndike, from Third, west . . . . .	3	383
Thorndike, from Seventh, east (Cement) . . . . .	4	912
Third, from Otis, south . . . . .	4	1,200
Third, from Cambridge, south . . . . .	3	158
Third, from Cambridge to Bridge . . . . .	4	500
Vine, from Third, west . . . . .	3	383
Winter, from Fifth to Bridge . . . . .	3	900
Water, from Bridge, north . . . . .	4	225

## MAIN PIPES IN SOMERVILLE.

	Size Inches.	Length Feet.
Bolton, from Oak . . . . .	3	288
Milk Row, from Bleachery to Tube Works . . . . .	4	1,899
Oak, from Prospect . . . . .	3	510
Webster Avenue, from Prospect (Cement) . . . . .	4	339
Webster Avenue, continued . . . . .	3	860

Whole number of supply pipes now laid, 2,191 ; supplying 2,650 families, 118 stores and offices, 10 school-houses, 3 churches, 17 garden hydrants, 64 stables, 6 fish markets, 5 printing offices, 39 manufactories, 3 public houses, 2 railroads, 1 steam tug, 5 fire engines, 1 nursery, 3 station houses, 1 college, 4 banks, 1 city hall, 7 bake houses, 3 bacon works ; making in all, 2,943 water takers.

Eighty-seven new supply pipes have been laid since May 1, 1865 ; supplying 102 families, 3 stables, 1 bake house, 4 garden hydrants, 6 manufactories, 8 stores and shops, 1 hotel, 1 printing office, 1 greenhouse.

THE FOLLOWING GATES AND STOP-COCKS HAVE BEEN ESTABLISHED  
IN CONNECTION WITH THE PIPE.

	Size :	
	No.	Inches.
At the Engine-House . . . . .	2	12
Near the Reservoir . . . . .	1	12
Near the Reservoir . . . . .	1	24
Brattle and Mason . . . . .	1	10
Brattle, near the Brattle House . . . . .	1	10
Brattle, near Ash . . . . .	1	4
Brattle and Brighton . . . . .	1	4
Brattle and Craigie . . . . .	1	4
Brattle and Palmer . . . . .	1	4
Cambridge and Prospect . . . . .	1	10
Cambridge, near Columbia . . . . .	1	8
Cambridge and Windsor, south . . . . .	1	4
Cambridge and Seventh . . . . .	1	4
Cambridge and Fifth . . . . .	1	4
Cambridge and Fourth . . . . .	1	4
Cambridge and Third . . . . .	1	4
Columbia and Washington . . . . .	1	4
Craigie Bridge . . . . .	1	3
Cambridge and Second . . . . .	1	6
Front, near Main . . . . .	1	3
Harvard, near Ware . . . . .	1	6
Harvard, near Essex . . . . .	1	4
Harvare Square and Dunster . . . . .	1	4
Harvard and Main . . . . .	1	4
Main and Dana . . . . .	1	8



	No.	Size : Inches.
Main and Columbia . . . . .	1	6
Main and Brookline . . . . .	1	4
Main and Cherry . . . . .	1	4
Main and Prospect . . . . .	1	4
Main and Putnam . . . . .	1	4
Main and River . . . . .	1	4
Mason and Phillips Place . . . . .	1	4
Magazine, near Erie . . . . .	1	4
Mt. Auburn, near Holyoke . . . . .	1	4
Milk Row (Somerville), near Bleachery . . . . .	1	6
Milk Row (Somerville), near Tube Works . . . . .	1	4
North Avenue, near Shepard . . . . .	1	6
North Avenue, near Sacramento . . . . .	1	6
Windsor, near Harvard . . . . .	1	4

STOP-COCKS.

	No.	Size : Inches.
Cambridge and Sumner . . . . .	1	
Cambridge and Irving . . . . .	1	2
Cambridge and Maple Avenue . . . . .	1	2
Cambridge and Fayette . . . . .	1	2
Cambridge and Inman . . . . .	1	2
Cambridge and Tremont . . . . .	1	2
Cambridge and Norfolk . . . . .	1	2
Cambridge and Windsor . . . . .	1	2
Cambridge and Third . . . . .	1	2
Cambridge and North Second . . . . .	1	2
Cambridge and Distillhouse . . . . .	1	2
Columbia and Worcester . . . . .	1	2
Brattle and Appleton . . . . .	1	2
Brattle and School Court . . . . .	1	2
Brighton and Winthrop Place . . . . .	1	2
Harvard and Trowbridge . . . . .	1	2
Holyoke and Holyoke Place . . . . .	1	2
Harvard and Linden . . . . .	1	2
Harvard and Quincy . . . . .	1	2
Harvard and Ware . . . . .	1	2
Harvard and Dana, north . . . . .	1	2
Harvard and Dana, south . . . . .	1	2
Main and Remington . . . . .	1	2
Main and Lee . . . . .	1	2

	No.	Size : Inches
Main and Pleasant . . . . .	1	2
Main and Clinton . . . . .	1	2
North Avenue and Mellen . . . . .	1	2
North and East . . . . .	1	2
Pearl and Auburn . . . . .	1	2
Pearl and Watson . . . . .	1	2
Oak and Prospect . . . . .	1	1½

WASTE GATES.

	No.	Size : Inches.
Bridge, near the Bridge . . . . .	1	3
Charles and Third . . . . .	1	3
Gas-house yard . . . . .	1	3
Front and Village . . . . .	1	2
Osborn's mill . . . . .	1	2

BLOW-OFF PIPES.

	No.	Size : Inches.
Buckingham, near A. Stevens's house . . . . .	1	1½
Allston, near J. Holmes's house . . . . .	1	1½
Quincy, near Broadway . . . . .	1	1½
Broadway, near E. Raymond's house . . . . .	1	1½
Ware . . . . .	1	1½
Norfolk, south of Harvard . . . . .	1	1½
Main, Lower Port, near Skinner's Wharf . . . . .	1	1½
Maple, near Hovey's house . . . . .	1	1½
Washington, near railroad junction . . . . .	1	1½
Elm, near Welch's house . . . . .	1	1½
Hampshire, north of Prospect . . . . .	1	1½
Tremont, near Broadway . . . . .	1	1½
Norfolk, north of Broadway . . . . .	1	1½
Columbia, north of Broadway . . . . .	1	1½
Broadway, near Boardman . . . . .	1	1½
Worcester, near Fiske's house . . . . .	1	1½
Chestnut Place, near the end . . . . .	1	1½
Hastings, near Burnhardt's house . . . . .	1	1½
Pine, near Buss & Merrill's house . . . . .	1	1½
Market, near Boardman's house . . . . .	1	1½
Hampshire, near Finnegan's house . . . . .	1	1½
Erie, near Reardon's house . . . . .	1	1½

	No.	Size : Inches.
Walnut Court, near Walnut . . . . .	1	1½
Valentine, near Grady's house . . . . .	1	1½
Spring, east from Fourth . . . . .	1	1½
Spring, west from Fourth . . . . .	1	1½
Thorndike, east from Fourth . . . . .	1	1½
Thorndike, west from Fourth . . . . .	1	1½
Livermore, near Hampshire . . . . .	1	1½
Lincoln, near Brown's house . . . . .	1	1½
Brookline, near Auburn . . . . .	1	1½
Kirkland, near Chamberlin's house . . . . .	1	1½
Austin, near Wheeler's house . . . . .	1	1½
Columbia, north from Cambridge . . . . .	1	1½
Webster Avenue, north from Cambridge . . . . .	1	1½
Sumner, near T. P. Lerner's house . . . . .	1	1½
Berkeley, near Mrs. Everett's house . . . . .	1	1½
Mellen, end of Sands block . . . . .	1	1½
Linden, near Mrs. Brown's house . . . . .	1	1½
Winthrop Place . . . . .	1	1½
Holyoke Place, near Mrs. Harvey's house . . . . .	1	1½
Mt. Auburn, near Dakin & Metcalf's . . . . .	1	1½
Mt. Auburn, near Whitney's house . . . . .	1	1½
Western Avenue, near Howard . . . . .	1	1½
Clark, near Hampshire . . . . .	1	1½
Norfolk, from Cambridge, north near Webster Avenue . . . . .	1	1½
Green, near Hampson's house . . . . .	1	1½
Vine, near Fourth . . . . .	1	1½
Bridge, near Train's store . . . . .	1	1½
North Second, near Gore . . . . .	1	1½
Trowbridge, near W. T. Richardson's . . . . .	1	1½
Fayette, near High School house . . . . .	1	1½
Essex, near Whitney's bake house . . . . .	1	1½
William, near Bradford's house . . . . .	1	1½
Lee, opposite Capt. Ryder's house . . . . .	1	1½
Temple, near Dr. Wellington's house . . . . .	1	1½
Spring, near Rindge's block . . . . .	1	1½
Inman, near Atwood's . . . . .	1	1½
Soden, near laundry . . . . .	1	1½
Thorndike, near Train's house . . . . .	1	1½
Charles, near Fourth . . . . .	1	1½
Third, near Oil Works . . . . .	1	1½
Ellsworth, near Cambridge . . . . .	1	1½

	No.	Size : Inches.
Bolton, near Mitchell's house . . . . .	1	1½
Fourth, near Casey's house . . . . .	1	1½
Clinton, near Benj. King's house . . . . .	1	1½
Kirkland, near Prof. Child's house . . . . .	1	1½
Magazine, near Franklin . . . . .	1	1½
Brookline, near Erie . . . . .	1	1½
Bridge, near Leland estate . . . . .	1	1½
Washington, near Newell Bent's house . . . . .	1	1½
Village, near corner of State . . . . .	1	1½

WATER GATES.

One 24-inch ; three 12-inch ; three 10-inch ; two 8-inch ; six 6-inch ; twenty-three 4-inch ; two 3-inch.

STOP-COCKS.

Thirty 2-inch ; one 1½-inch.

WASTE GATES.

Three 3-inch ; two 2-inch.

BLOW-OFF PIPES.

Seventy-three 1½-inch.



RECAPITULATION.

63 feet 24-inch iron pipe.	6,000 feet 8-inch iron pipe.
306 " 20 " "	12,011½ " 6 " "
5,950 " 12 " "	60,501 " 4 " "
12,180 " 10 " "	34,529 " 3 " "

CEMENT PIPE.

1,000 feet 10-inch ; 3,790 feet 6-inch ; 3,070 feet 4-inch.

CAMBRIDGE, August 12, 1865.

*The following table exhibits the result of certain experiments made at the Engine-house of the Cambridge Water Works, with various kinds of coal, and on different grates; the steam in the boiler, and temperature of water pumped into the boiler, being the same at the commencement of each experiment.*

Kind of Coal.	Weight.	Clinkers.	Ashes.	Grate.	Steam in Boiler.	Vacuum.	Speed of Engine.	Temp. in Well room.	Temp. water pumped into Boiler.	Revolutions.	Gallons Pumped.	No. of gallons per lb. Coal.
Lackawanna . .	1 ton.	52 lbs.	211 lbs.	Fr. arched.	40 to 44	27½	45 to 55	84½ deg.	192 deg.	37,194	1,264,596	632
Cumberland . .	1 "	21 "	164 "	"	"	"	"	"	"	39,468	1,341,912	670½
Sidney . . . . .	1 "	131 "		Flat Grate.	"	"	"	"	"	24,187	822,358	411
Lackawanna . .	1 "	41 "	192 "	"	"	"	"	"	"	31,841	1,082,594	541
Lackawanna . .	1 "	18½ "	194 "	Fr. arched.	"	"	"	"	"	39,811	1,353,574	676½
Cumberland . .	1 "		130½ "	Flat.	"	"	"	"	"	39,695	1,349,630	674½

City of Cambridge.

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THE

SECOND ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL;

TOGETHER WITH THE REPORT OF THE SUPERINTENDENT  
FOR THE YEAR 1886



[REPRINT]

CAMBRIDGE:

JOHN WILSON AND SON

Printers, 15, N. Market St.

1889.



**City of Cambridge.**

—◆—  
**THE**

**32021**

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**1890.**

☆ **CAMBRIDGE PUB. LBRY**





# R E P O R T

OF

## THE CAMBRIDGE WATER BOARD.

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As required by Ordinance, the Water Board herewith submits its Annual Report, "containing a statement of the condition of the Water Works, and property connected therewith; with an account of receipts and expenditures, together with such information or suggestions as they may deem important."

The Board has been engaged during the year in enlarging the capacity of the works in all particulars, so as to meet, as quickly as possible, the increasing demand for water. Early in the season a competent engineer — Mr. George H. Bailey, engineer of the Newark, New Jersey, Water Works, formerly in the Boston Water Office — was employed to make a survey of the works, and report the plan best adapted, in his judgment, to secure an ample supply for the city, present and prospective. Mr. Bailey attended to the duty required, and reported a system of enlargement which was substantially adopted, it having been in almost entire accordance with the previously conceived views of the Board. The method of Mr. Bailey embraced five points, which may be stated briefly thus: 1. A new pump main from the pond to the reservoir. 2. A large main from the reservoir through Appleton, Brattle, and Craigie Streets to Concord Avenue, thence down that avenue across the Common, through Broadway to Court Street, Lower Port. 3. A smaller pipe from the junction of Concord Avenue and Craigie Street, along the avenue through Bond, Garden, and Linnæan Streets, to North Avenue, and through to Beech Street. 4. From the junction of Broad-

way and Court Street to East Cambridge. 5. From the Broadway main, a pipe through Inman and Pleasant Streets, as a supply for all that section lying south of Main and east of River Streets.

The engineer's estimate of the cost of these extensions was \$194,117.00, allowing a discount of twenty-five per cent on such portions as were laid with cement pipe, which he thought could be used of sizes not larger than ten or twelve inch. But as a comparatively small amount has been laid, and as the actual cost of iron pipe has slightly exceeded his estimates, it will be safe to conclude that the result will show his figures to have been nearly correct.

The Board has prosecuted the work with all the means in their power, nowise impeded except by causes beyond their control. Some delay has been caused by the non-delivery of the pipes at the time agreed upon; but from all causes combined there has been no very great interruption to the progress of the extension. The force main, a 24-inch pipe, is well in hand, being now about half laid down. The main from the reservoir to junction of Broadway and Cambridge is completed and in use. This consists of 24-inch pipe from the reservoir to Concord Avenue, and of 20-inch for the remainder of the route. The pipe is also laid down from junction of Concord Avenue and Craigie to North Avenue, and north as far as Rice Street. The new reservoir is completed; also a standpipe, which the Board decided to erect at the reservoir, as a means of furnishing abundant water to the highest service in the city, at all times and in any conceivable contingency, is very nearly done.

The Board confidently believe that, should the City Council furnish the means, the whole project can be successfully accomplished the coming year, and the people supplied with all the water they desire. More particularly should the Broadway main be put in, as it would operate powerfully to induce the establishment of manufactories, and a consequent increase of dwellings and people to occupy the vacant lands lying in the vicinity of the lower part of that street, thus enhancing the water revenue and the city's valuation. With a view to this, and another object to be mentioned hereafter, we ask that the

City Council place at the disposal of the Board, for the year 1867, an appropriation of one hundred and fifty thousand dollars.

Financially the Water Works are in excellent condition.

Their net cost, Dec. 1, 1865, was . . . . .	\$278,185.20
Since expended for construction and interest on bonds issued for the purchase, and to raise means for extension . . . . .	105,669.74
Making a total of . . . . .	\$383,854.94
Deduct excess of income over expenses this year . . . . .	28,728.82
	<hr/> \$355,126.12

Receipts from all sources for 1866 (including interest credited to the Water Works) . . . . .	\$51,398.59
Receipts from all sources for 1865 . . . . .	37,605.48
Increase in 1866 . . . . .	<hr/> \$13,793.11

As required by the Act of the Legislature, which authorized the City to purchase the works, a sinking fund, for the final redemption of the water debt, has been commenced by the application of an amount of nearly six thousand dollars. The Commissioners — the Mayor, President of the Common Council, and City Treasurer — have now the funds in charge.

There can be no doubt that, were the projected improvements completed, the gross receipts would in two years or, at the farthest, three years, reach to upwards of eighty thousand dollars.

The position and general condition of the Water Works are highly flattering, and, we have no question, will be so regarded by our people. The small cost, compared to that of other places about us, is very striking indeed. The City of Boston has expended upon the Cochituate Water Works nearly seven millions of dollars. In no year have the receipts equalled the expenditures. To say that, by this result, it would appear that the introduction of the water into that city was unwise, would be to take a one-sided and partial view of the case. Since the year 1848, when the water was first made available to the citizens of Boston, their valuation has increased more than two hundred millions of dollars. To what extent this increase is owing to

the ample supply of water furnished we cannot determine, but it must be very largely ; for in that city, as in ours, there were, at the time of the introduction of the water, large tracts of ground unimproved. These tracts are now covered with buildings, and densely peopled ; which could not have been accomplished in so short a time as from fifteen to eighteen years, had there not been a copious supply of water. The City of Charlestown, with an area and population and valuation less than our own, has expended not less than eight hundred thousand dollars upon the Mystic Water Works. The City of Salem, also, is now engaged in procuring water for its people, at a contemplated cost of a million dollars, if we are rightly informed. Now, the large comparative excess of cost, in the three cities named, above our own works, is owing in a great measure to the distance that the water is moved. In this respect we have an immense advantage. The Boston water is brought nearly, if not quite, fourteen miles before it reaches the consumer : in Charlestown it is brought perhaps four miles, and in Salem five or six miles, before it strikes the taker. In Cambridge we commence delivery within a hundred feet of the reservoir, and within twenty-four hundred feet of the pond, the source of supply. This is a very important consideration, having a weighty effect on the cost of the works. And we believe that our people will forever have cause to commend the wisdom of that City Council which purchased these works, and brought them within the control of the citizens. Next to its public roads and streets, we place this property as a power to advance the material interests of the city.

The Board will no doubt be compelled at no distant day to incur the expense of lowering the pipes in River Street and Western Avenue. Since these pipes were laid, the City has reduced the grade of these streets perhaps two feet. This endangers the pipes, by leaving them too near the surface and within frost mark.

Some outlay has been made the past year upon the boilers and pumps, and in and about the buildings at the pond. Everything is now in good working order. As the demand for water increases, the attention of the Board is attracted by the probable need, at a time not far off, of an augmentation of the pumping



power. The engines are now in excellent condition, though they have been ten years in use ; and the work required of them the past year has been larger than ever before, — the number of gallons pumped *daily*, over that of 1865, being more than 137,000 gallons ; and the demand is still greater since the connection was formed between the main at the junction of Cambridge Street and Broadway and the old pipe leading to East Cambridge, by which the Third Ward has been greatly relieved. It is believed that when a pipe is laid along Court Street from Broadway, that ward, which has hitherto suffered so much from a lack of water, will be amply supplied.

It is with a view to the enlargement of the pumping force, that the Board ask for so large an appropriation as that heretofore stated. They wish to be in a position, should circumstances demand, of putting in a new engine. We deem this a subject of vast importance, and it is brought to the earnest attention of the City Council ; for it can easily be seen that, should the present pumps become disabled from any cause, the people will be cut off from their supply for an indefinite period. The matter of new engines, moreover, requires much investigation ; for since those the City now owns were built, many improvements have been made in that branch of mechanics ; and when a new one is procured, it should be of the best pattern for effective force and economy of management. The contingency of being obliged to obtain a new engine appears the more serious from the fact that we are now requiring of our pumps double the work that it was thought they were capable of at the time they were made.

Since the first of November last, Mr. Robert Douglass, the member of the Board from Ward Four, has been the Acting Superintendent, in place of Mr. George W. Fifield, who had occupied that office since the works came into the City's possession ; he having resigned to engage in other employment.

For all details in regard to the increase of customers, of supplies, and pipes, large and small, during the year just closed, and other matters in relation to the works, the Board beg leave to refer to the Annual Report of the Superintendent, herewith submitted, trusting that it will be found to contain all that is necessary for the full information of the City Council and their constituents.

The Board are of the opinion that the interest of the works demands the entire time of the Superintendent, in looking after the extension, the improper use of the water, and matters generally relating to pipes and out-of-door service; and that a Water Registrar should be appointed, whose duty it shall be to attend to all the affairs of the Water Office, now performed by the Superintendent and his clerk; and they recommend that these changes be effected by an alteration of the Ordinance, making the Registrar responsible to the City for the proper discharge of his duties.

In closing this Report, the Board would respectfully call the attention of the City Council to that section of the Water Ordinance which requires that the Mayor of the city shall be Chairman of this Board, and consequently its chief executive officer; and to suggest its alteration, so that the Board may have a permanent chairman, to be selected from its elective members, who shall administer its affairs. This is the practice in other cities, and seems to be necessary in order that a steady and uniform policy in care and management may be pursued; which all will concede to be desirable. An amount of labor is exacted by the Charter and Ordinances of the Mayor of Cambridge greater than is required of its chief officer by any other city within our knowledge.

The Water Works demands of its executive head much time, and an extent of information peculiar to such enterprises that cannot be acquired except by years of practical acquaintance with their construction and management. The incumbent of the mayoralty is changed very frequently, — biennially, we believe, on an average, since the adoption of the Charter, — and it cannot be expected that any one new to the place should be able to administer its affairs, at first sight, so successfully as after years of service.

The members of the Board are elected to serve for five years. This long term of office shows very plainly that the City Council, in establishing it, intended to avoid changes, and secure permanent service as essential to successful management.

The Mayor and President of the Common Council are now *ex-officio* members of this Board; and we think it desirable that

they should remain, as means of communication between the Board and the two branches of the City Government; but we submit that the elective members should be the working force, selected, as they are, from among the citizens at large, with a special view to their fitness for the position.

This change would effect a double purpose of advantage to the city; for the Mayor, who is now confessedly overburdened with the cares and details of the City Government, would be essentially relieved, and the responsibility of the management of the Water Works will be placed where it was evidently the intention of the framers of the Ordinance that it should be placed, namely, in the hands of the elective members of the Board.

Respectfully submitted,

J. WARREN MERRILL,	}	<i>Cambridge Water Board.</i>
JOHN SARGENT,		
A. K. P. WELCH,		
SAM'L SLOCOMB,		
ROBERT DOUGLASS,		
JOHN S. MARCH,		
C. W. KINGSLEY,		

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IN BOARD OF ALDERMEN, Jan. 5, 1867.

Accepted and ordered to be printed with the next City Documents.

Sent down for concurrence.      Attest:

JUSTIN A. JACOBS, *City Clerk.*

IN COMMON COUNCIL, Jan. 5, 1867.

Concurred.      Attest:

JOS. G. HOLT, *Clerk.*



**R E P O R T**  
**OF**  
**THE SUPERINTENDENT OF THE WATER WORKS.**

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OFFICE OF THE WATER WORKS, CITY HALL,  
Dec. 1, 1866.

*To the Cambridge Water Board :*

GENTLEMEN,—In compliance with the ninth section of the Ordinance providing for the care and management of the Cambridge Water Works, I herewith submit my Second Annual Report.

The net cost of the works, as per last Report, was . . .	\$278,185.20
Since expended on construction . . . .	\$88,185.74
Interest on original purchase to Dec. 1 . . .	17,484.00
	<hr/>
	105,669.74
Making the total cost of the works at this time . . . .	<hr/> \$383,854.94

The following is a statement of main and branch pipes laid since last Report, the streets through which they are laid, their size, length, etc. ; also all the gates, stop-cocks, waste gates, and blow-off pipes set since last Report.

LOCATION OF NEW MAIN AND BRANCH PIPES.

STREETS.	Size :	Length :
	Inches.	Feet.
From Reservoir, through Highland, Appleton, Brattle, and Craigie (Iron) . . . . .	24	3,645
From Craigie, through Concord Avenue to Cambridge (Iron)	20	2,769
From Concord Avenue, through Garden, Bond, and Lin- naen to Railroad Crossing (Cement) . . . . .	10	4,916.6
North Avenue, at Railroad Crossing (Iron) . . . . .	10	110.6

	Size : Inches.	Length : Feet.
North Avenue, from Railroad Crossing to Beech (Cement)	8	736.6
North Avenue, from Beech to Rice (Cement) . . . . .	6	2,661.6
Main, from Foundry to junction of Broadway (Cement) .	6	3,113.9
Walnut, east from Pleasant (Iron) . . . . .	6	491
North Avenue, near Chapel, to connect with Cement pipe (Iron)	6	48.6
First, south from Otis (Iron) . . . . .	4	211
Chapel, west from North Avenue (Iron) . . . . .	4	448
Pleasant, south from Walnut (Iron) . . . . .	4	333
Dana, south from Cambridge (Iron) . . . . .	4	580
Wendell, east from North Avenue (Iron) . . . . .	4	461
Lee, north from Harvard (Iron) . . . . .	4	256
Main, east from junction of Broadway (Iron) . . . . .	4	1,300
Mt. Auburn, east from printing office (Iron) . . . . .	4	200
Berkeley, west to Craigie (Iron) . . . . .	4	138
Forest, east from North avenue (Cement) . . . . .	4	742.4
Chester, north from North avenue (Cement) . . . . .	4	522.8
Hancock, north from Harvard (Iron) . . . . .	3	448
Broadway, east from E. Raymond's (Iron) . . . . .	3	90
Walnut Court, south to Walnut (Iron) . . . . .	3	52
Howard, south from Mt. Auburn (Iron) . . . . .	3	272
Auburn, east from Auburn Court (Iron) . . . . .	3	222
Ellery, north from Main (Iron) . . . . .	3	215 .
Story, south from Brattle (Iron) . . . . .	3	311
Winthrop, west from Winthrop Square (Iron) . . . . .	3	78

THE FOLLOWING GATES AND STOP-COCKS HAVE BEEN ESTABLISHED IN  
CONNECTION WITH THE PIPES LAID THE PRESENT YEAR.

STREETS.	Size :	
	No.	Inches.
Near the Reservoir . . . . .	2	24
Junction of Craigie and Concord Avenue . . . . .	1	20
Junction of Cambridge and Kirkland . . . . .	1	20
At Reservoir . . . . .	1	16
Highland . . . . .	2	12
Concord Avenue, near Craigie . . . . .	1	10
North Avenue, near Railroad Bridge . . . . .	1	10
Cambridge, near Kirkland . . . . .	1	10
North Avenue, near Beech . . . . .	1	8

	Size :	
	No.	Inches.
North Avenue, near Rice . . . . .	1	6
North Avenue, near Chapel . . . . .	1	6
North Avenue, near Holmes Place . . . . .	1	6
North Avenue, near Follen . . . . .	1	6
Craigie, near the culvert . . . . .	1	6
Brattle, near Sparks . . . . .	1	6
Main, near Osborn . . . . .	1	6
Main, at junction of Harvard . . . . .	1	6
Waterhouse, at Concord Avenue . . . . .	2	6
At Reservoir . . . . .	1	6
North Avenue, at Chapel . . . . .	1	4
Main, at Ellery . . . . .	1	4
Cambridge, at Dana . . . . .	1	4
North Avenue, at Wendell . . . . .	1	4
Harvard, at Lee . . . . .	1	4
Main, near Harvard (Ward 2) . . . . .	1	4
Main, near the Bridge . . . . .	1	4
Linnæan, near Avon . . . . .	1	4
Concord Avenue, near Craigie (on hydrant branch) . . . . .	1	4
Craigie, near the culvert . . . . .	1	4
North Avenue, near Forest . . . . .	1	4
North Avenue, near Chester . . . . .	1	4
Brattle, at Ash, to replace one broken . . . . .	1	4
Walnut, at Walnut Court . . . . .	1	3
Harvard, at Hancock . . . . .	1	2
Mt. Auburn, at Howard . . . . .	1	2
Brattle, at Story . . . . .	1	2
Berkeley, at Craigie . . . . .	1	2

BLOW-OFF PIPES.

Craigie, near the culvert . . . . .	1	6
Main, near the Bridge . . . . .	1	4
Hancock, near Broadway . . . . .	1	1½
Chapel . . . . .	1	1½
Howard . . . . .	1	1½
Auburn . . . . .	1	1½
Ellery . . . . .	1	1½
Story . . . . .	1	1½
Dana . . . . .	1	1½

	Size :	
	No.	Inches.
Wendell . . . . .	1	1½
Lee . . . . .	1	1½
North Avenue, at Rice . . . . .	1	1½
Chester, at Orchard . . . . .	1	1½
Forest, at Oxford . . . . .	1	1½
Sixth, at Cambridge . . . . .	1	1½
Auburn, at Pearl . . . . .	1	1½

The new reservoir is nearly completed, and will soon be ready for use ; and though not as large as would have been desirable, still, when the old reservoir is rebuilt, and raised to a level with the new one, it would seem as though the storage room would be ample for the wants of the city, as no space is required for subsiding the water. The new reservoir is very thoroughly built, and will be rather an ornament to the neighborhood.

Receipts.

Received for water to Dec. 1, 1866 . . . . .	\$40,073.27
Expended for care and repairs . . . . .	13,791.00
	<hr/>
Balance in favor of works . . . . .	\$26,282.27

The expense at the pond has been considerably increased the past year by repairs on the boilers and pumps, and by the purchase of a new boiler pump ; also in filling and grading, and other improvements in and about the buildings.

Another item of considerable expense, chargeable to care and repairs, has been upon old gates, in setting new boxes, and oiling and repairing the gates. The works are believed to be at this time in good repair.

Number of abatements for a short supply of water, 77 ; amounting to . . . . .	\$349.50
For vacancy, 20 ; amounting to . . . . .	96.91
	<hr/>
Total number of abatements, 97 ; amounting to . . . . .	\$446.41

Water cut off from supply pipes for non-payment of rates, 6 times.  
Number of leaks in main pipes 43, all of which were at the joints, and all but one were repaired without shutting off the water.  
Number of leaks in aqueduct log 9, all repaired with water on.

One old 4-inch gate, having been broken, has been taken out and a new one set in its place, on Brattle at Ash Street.

Average number of gallons pumped daily the past year . . .	1,111,339
Average number of gallons pumped to reservoir for each hundred pounds of coal burned . . . . .	64,062
Average daily increased consumption over last year . . .	137,307
Average daily consumption for each taker . . . . .	307

#### Supply Account.

Cash received on above account . . . . .	\$10,883.30	
Now due . . . . .	2,686.90	
	<hr/>	\$13,570.20
There was reported as due in last Report . . .	\$3,627.01	
Since expended . . . . .	8,878.80	
	<hr/>	12,505.81
		<hr/>
Balance in favor of supply account . . . . .		\$1,064.39
Total cash receipts from all sources the past year . . .		\$50,956.57
Paid the City Treasurer . . . . .		50,956.57

#### Recapitulation.

Cost of the works, Dec. 1, 1865 . . . . .	\$278,185.20
Since expended . . . . .	\$88,185.74
Interest on first cost to date . . . . .	17,484.00
	<hr/>
	105,669.74
	<hr/>
Aggregate cost of works, Dec. 1, 1866 . . . . .	\$383,854.94
Deduct income from water, etc., above expenditure, to Dec. 1, 1866 . . . . .	\$28,286.77
Interest allowed by City Treasurer to June 30, 1866 . . . . .	442.05
	<hr/>
	28,728.82
	<hr/>
Net cost of works, Dec. 1, 1866 . . . . .	\$355,126.12

One hundred and seventy-one new supply pipes have been laid since Dec. 1, 1865; supplying 180 families, 13 stables, 1 fruit-preserving house, 1 bake house, 1 school house, 5 garden hydrants, 11 manufactories, 3 stores and offices, 1 greenhouse, 3 churches, 9 stationary engines, 1 boarding house.

Increasing the rates, when all in use . . . . .	\$2,600.00
Whole number of supply pipes now laid . . . . .	236,200

STATEMENT

Showing the number of families, stores, manufactories, etc., supplied with Fresh Pond water to Dec. 1, 1866: 3,010 families, 130 stores and offices, 210 stables, 39 garden hydrants for hand hose, 25 boarding houses, 14 school-houses, 5 churches, 59 manufactories, 47 stationary engines, 12 bake houses, 5 fish markets, 5 fountains, 4 fire engines, 6 printing offices, 3 post offices, 4 book-binderies, 3 public houses, 4 photograph rooms, 3 greenhouses, 4 glass works, 2 oil factories, 2 bacon works, 2 cow pastures, 3 police stations, 1 city hall, 1 steam tug, 1 gas works, 1 bleachery, 1 house of correction, 1 nursery, 1 laundry, 1 gymnasium, 1 university, 1 public library, 1 fruit-preserving house, 1 slaughter house, 1 distillery, 1 railroad, 1 brewery, 1 cattle market.

STATEMENT

Of stock on hand pertaining to construction, exclusive of tools:—

227 plates annealed iron, 11 × 36 × 68,	20,183 lbs.
640       “       “       9 × 36 × 81½,	84,986
	<hr/>
	105,169 lbs. @ 6 cts., \$6,310.14

Seven 12-inch cast-iron pipes.	One 24-inch gate.
Thirty-six ft. 10-in. cast-iron pipes.	One 20-inch gate.
Four 8-inch cast-iron pipes.	One 10-inch gate.
Six 6-inch cast-iron pipes.	Six 4-inch gates.
Six 4-inch cast-iron pipes.	One 24-inch × 20-inch tee.
Six 3-inch cast-iron pipes.	One 20-inch × 10-inch tee.
Seven 10-inch cast-iron ½ bends.	One 12-inch tee.
Two 24-inch cast-iron sleeves.	Two 6-inch tees.
Two 20-inch cast-iron sleeves.	Seven 3-inch tees.
One 12-inch cast-iron sleeve.	One 10-inch tee.
Four 10-inch cast-iron sleeves.	Two 24-inch elbows.
Two 8-inch cast-iron sleeves.	Three 4-inch elbows.
Four 6-inch cast-iron sleeves.	Three 4-inch crosses.
Eleven 4-inch cast-iron sleeves.	One 3-inch cross.
One 3-inch cast-iron sleeve.	One 12-inch to 6-inch reducer.
Twelve cast-iron gate frames and covers.	Twelve 6-inch to 4-inch reducers.

Respectfully submitted,

GEORGE W. FIFIELD,  
*Superintendent.*



City of Cambridge.

3 ANNUAL REPORT

OF

THE WATER BOARD

TO

THE CITY COUNCIL,

FOR THE YEAR 1867.

REPRINTED FROM THE FORMER REPORT



CAMBRIDGE:

PRESS OF JOHN FORD & SON,

1872.





City of Cambridge.

ANNUAL REPORT: 1867

OF

THE WATER BOARD

TO

THE CITY COUNCIL,

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☆ CAMBRIDGE PUB. LIBRY



# R E P O R T

## OF THE

### C A M B R I D G E W A T E R B O A R D.

In compliance with an ordinance of the City, the Cambridge Water Board herewith present to the City Council their third

#### A N N U A L R E P O R T,

Embracing a statement of the progress of the Works during the present year, their present condition, with an account of the receipts and expenditures, clearly demonstrating the fact that, notwithstanding the large expenditures which have been made the last two years, the Water Works are a self-sustaining institution.

The net cost of the Works, December 1, 1866, was	\$355,126.12
Expended for construction the present	
year,	\$188,625.06
Interest on Water debt,	27,984.00
	<u>216,609.06</u>
Total,	\$571,735.18
Deduct excess of income over expense,	39,461.54
	<u>Net cost of the Works, December 1, 1867, \$532,273.64</u>
Receipts from water-rates for the year ending December 1, 1867,	\$52,733.62
Receipts from water-rates for the year ending December 1, 1866,	40,073.27
	<u>Increase of water-rates, \$12,660.35</u>

Receipts from all sources for the year ending December 1, 1867, . . . . .	\$66,040.66
Receipts from all sources for the year ending December 1, 1866, . . . . .	51,398.59
	<hr/>
Increase of receipts in 1867, . . . . .	\$14,642.07

For a more specific statement of the financial account of the Water Works, reference may be had to the accompanying report of the Water Registrar, marked A.

The sinking fund authorized by the Legislature for the final redemption of the Water debt amounted on the first day of July, 1867, to \$18,935.89, and is in charge of the Commissioners appointed for that purpose.

In the prosecution of the work the present year a 24-inch pumping main has been laid from the engine-house to the reservoir, a distance of 2,465 feet.

A 20-inch street main has been laid from the termination of the pipe laid last year, near the junction of Broadway and Cambridge Street, down Broadway to Court Street, a distance of 10,072 feet.

A 12-inch street main has been laid from the Broadway pipe, through Court and Third Streets, to Bridge Street, a distance of 3,915 feet; and also on Inman Street from Broadway to Harvard Street, 492 feet. Total of 12-inch pipe, 4,407 feet.

We have also laid 129 feet of 6-inch pipe in Dock Street, and in various localities 15,590 feet of 4-inch and 2,550 feet of 3-inch pipe; making a total of all sizes of pipe laid the present year of 35,214 feet. Whole amount of pipe of all sizes connected with the Works, 194,958 feet, or nearly 37 miles. For a detailed account of the location of the pipe, and for a full and definite statement of all branches of the work performed, we would refer you to the accompanying report of the Superintendent, which is hereunto annexed, marked B.

All this work has been done to carry forward the plan recommended by Mr. George H. Bailey, the Engineer employed in the early part of the year 1866, which recommendation was in accordance with the views entertained by this Board, and which they have substantially adhered to thus far.

Several months ago the Board decided to place meters upon all

large supplies, and the result thus far has been highly satisfactory, showing a large increase in the water-rates. Eight new meters have been set this year, making fourteen now in use. Thirty-one hydrants have been set, most of which are connected with the large mains laid this year, which will be of great service in case of fire. During the present year, we have lowered a portion of the pipes in Spring Street and Western Avenue, and have relaid a portion of the pipe in Otis Street.

We have built a house upon the land purchased of Mr. Josiah Coolidge, for the Engineer at the Engine-House, at a cost, including fences, of about \$3,200.

No progress has been made in the contemplated work at the Reservoir, except to procure the second tier of coping-stones for the new Reservoir (which had already been contracted for), the appropriation made at the early part of the year not being sufficient to warrant the Board in prosecuting that work, unless they abandoned laying some portion of the large mains which have been laid, and which they believed to be of the first and most vital importance to the great body of water-takers. The result of laying these large pipes has clearly demonstrated the correctness of our views in this respect, for we find that the water now flows into the second story of every house but two connected with the Works. We hope, when the reservoirs are completed, giving an increased head of some five feet, every house will receive an abundant supply. Should this not prove to be so, the stand-pipe, which may be completed at small expense, will remove all difficulty, and enable us to supply abundantly buildings that may be erected on the highest land in the City.

The increased number of water-takers early admonished the Board that the time had arrived when it became their imperative duty to take measures to increase the pumping power before the present pumps had become entirely overburdened, and the interests of the citizens endangered by their failure, in consequence of their being forced beyond their legitimate capacity. Consequently, in the early part of the year, a committee was appointed, with instructions to make a thorough examination of the different pumps in use by the various water works in this part of the country; having regard not only to the cost of the pumps, but particularly to the economy with which the required work could be performed by the



different pumps examined. After a full and careful examination, covering a period of several months, that committee reported in favor of Worthington's Duplex Pump, being the same as those now in use, but embracing important improvements. The report of that committee, giving in detail the reason upon which their decision was based, is hereto annexed, marked C, to which your attention is respectfully invited.

The recommendation of that committee, sustained as it was by our own experience with the pumps now in use for some twelve years, was adopted by the Board, and a contract has been entered into with Henry R. Worthington, Esq., for a pump capable of raising into our reservoir five million gallons in twenty-four hours, at a cost of \$40,000, including pump-boilers, foundations, connecting-pipes, &c., together with all plans and drawings necessary for the completion of the work covered by the contract. The whole work is to be completed by the first day of June, 1868, should the City of Cambridge complete the necessary enlargement of the building required for that purpose before that time.

In addition to this work, it will be necessary to excavate a channel from the well-room into the pond, a distance of some 275 feet, to enable us to draft our supply directly from deep water. The best method of performing this work has not yet been fully determined upon.

The Board intend also to make arrangements to complete the Reservoirs early in the spring, and hope to be able to complete both Reservoirs during the summer. When these two objects shall have been accomplished, and the twelve-inch pipe extended from Harvard Street to the southerly part of Ward Four, the great outlay required for the proper extension of the Works will have been made, and the future expenses will be confined mainly to the lateral extension of the smaller pipes as the wants of the inhabitants shall from time to time require.

In extending the present Engine-House to the north for the reception of the new pump, we shall be compelled to occupy a portion of the ground now occupied by the coal-shed, which will necessitate the building of a new coal-shed. This coal-shed should be built at the other end of the Engine-House to enable us to reach it by the railroad track if we so desired, which will be the case whenever we shall land our coal at Charlestown, which we may

often wish to do. The City of Cambridge does not own sufficient land, and we would recommend the purchase of a strip upon the edge of the pond of Jacob Hittinger, Esq., sufficient for that purpose. We would also recommend the purchase of a small strip of land north of the Engine-House, and lying between our present line and the northerly line of the land which we purchased of Josiah Coolidge, extended across the railroad to the point of intersection with our northerly line in the pond, for the purpose of storage and for the future security of our buildings. Mr. Hittinger expresses a willingness to accommodate the City upon reasonable terms.

We would also call the attention of the City Council to the imperative necessity of procuring some place for storage of the materials belonging to the Water Works. A large amount of material, and some of it of a costly nature, must of necessity be kept on hand to meet any contingency which may arise, a portion of which should at all times be kept under cover. We think sufficient land should be procured for the storage of all our material, and a proper shed built for the security of such materials as require shelter. We trust this subject will claim your early attention.

All of which is respectfully submitted,

JOHN SARGENT,	} <i>Cambridge Water Board.</i>
EZRA PARMENTER,	
SAML. SLOCOMB,	
ROBT. DOUGLASS,	
A. K. P. WELCH,	
C. W. KINGSLEY,	
M. T. BIGELOW,	



*In Board of Aldermen, December 18, 1867.*

Accepted, and, together with the accompanying documents,  
ordered to be printed with the next City documents.

Sent down for concurrence.

Attest :

JUSTIN A. JACOBS, *City Clerk.*

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*In Common Council, December 28, 1867.*

Concurred.

Attest :

JOS. G. HOLT, *Clerk.*

**A.**

**R E P O R T**  
**OF**  
**T H E W A T E R R E G I S T R A R .**

---

**OFFICE OF THE WATER WORKS,**  
**Cambridge, December 1, 1867.**

*To the Cambridge Water Board:—*

**GENTLEMEN,**— I herewith submit the following Report, as required by the Ordinance providing for the care and management of the Cambridge Water Works:—

**RECEIPTS.**

The total amount of water-rates received for the year  
ending November 30, 1867, was . . . . \$52,733.62  
Cash received on supply account, . . . . 11,647.55  
“ “ from sales of sheet iron, . . . . 1,659.49  

---

Total cash receipts from all sources, . . . \$66,040.66  
All of which has been paid into the City Treasury.

**EXPENDITURES.**

The expenditures for the care and management of the Works for the year ending November 30, 1867, have been as follows:—

For care and repairs, . . . . . \$9,494.71  
“ pumping service, . . . . . 6,129.61  
“ office expense, . . . . . 2,189.00  

---

Total amount, . . . . . \$17,813.32

The expenditure on the extension of the Works for the year ending November 30, 1867, was . . . . .	\$188,625.06
The expenditure on supply account for the year ending November 30, 1867, was . . . . .	9,765.14
Received for water-rates for the year ending November 30, 1867, . . . . .	\$52,733.62
Expended for the care and management of the Works, . . . . .	17,813.32
	<hr/>
Balance in favor of the Works, . . . . .	\$34,920.30

SUPPLY ACCOUNT.

Cash received on above account, . . . . .	\$11,647.55	
Now due, . . . . .	2,458.58	
	<hr/>	\$14,106.13
There was reported as due December 1, 1866, . . . . .	\$2,686.90	
Since expended, . . . . .	9,765.14	
	<hr/>	12,452.04
		<hr/>
Balance in favor of account, . . . . .		\$1,654.09

During the year there have been 58 cases where abatements have been made on water bills.

For short supply of water, 36 ; amounting to . . . . .	\$211.75
“ vacancy, 22 ; amounting to . . . . .	103.62
	<hr/>
Total amount of abatements, . . . . .	\$315.37

During the year the water has been turned off, for non payment of rates, 31 times. Of this number 25 have been let on, leaving a balance of 6 still remaining off.

248 supply pipes have been laid since December 1, 1866, supplying  
265 Families.

19 Stables.

9 Manufactories.

4 Garden Hydrants.

4 Stationary Engines.

2 Stores.

2 Greenhouses.

2 Slaughter-Houses.  
 1 Observatory.  
 1 State Arsenal.  
 1 Public House.  
 1 Boarding-House.  
 1 Laboratory.  
 1 Church.  
 1 Marble Works.  
 1 Cattle Yard.  
 1 Cow Pasture.  
 1 Foundry.

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## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, &c., SUPPLIED WITH FRESH POND WATER TO  
 DECEMBER 1, 1867.

3,299 Families.  
 143 Stores and Offices.  
 237 Stables.  
 59 Manufactories and Shops.  
 43 Garden Hydrants.  
 142 Hand Hose.  
 51 Stationary Engines.  
 118 Fire Hydrants.  
 25 Boarding-Houses.  
 14 Bakeries.  
 14 Soap Factories.  
 10 Saloons.  
 7 Greenhouses.  
 7 Fountains.  
 6 Furniture Manufactories.  
 5 Churches.  
 5 Photograph Rooms.  
 5 Banks.  
 5 Book Binderies.  
 5 Printing Offices.

4 Fire-Engine Houses.  
 4 Billiard Halls.  
 4 Iron Foundries.  
 4 Horse-Railroad Stables.  
 4 Cow Pastures.  
 4 Glass Manufactories.  
 3 Police Stations.  
 3 Public Houses.  
 3 Slaughter Houses.  
 2 Club Stables.  
 2 Laboratories.  
 2 Oil Works.  
 2 Chemical Works.  
 2 Bacon Works.  
 2 Cattle Yards.  
 2 Confectioners.  
 1 Steam Tug.  
 1 Gas Works.  
 1 Distillery.  
 1 House of Correction.  
 1 Cigar Manufactory.  
 1 Marble Works.  
 1 Reversible Collar Co.  
 1 Fruit-Preserving House.  
 1 City Hall.  
 1 University.  
 1 Gymnasium.  
 1 Laundry.  
 1 Nursery.  
 1 Observatory.  
 1 State Arsenal.  
 1 Bleachery.  
 1 Tube Works.  
 1 City Stable.  
 1 Public Library.  
 1 Stereotype Foundry.

During the year 8 meters have been applied to the premises of water-takers.

**STATEMENT SHOWING THE NUMBER AND SIZES OF METERS  
IN USE, DECEMBER 1, 1867.**

	SIZE OF METERS.				
	$\frac{3}{4}$ inch.	$\frac{3}{4}$ inch.	1 inch.	2 inch.	4 inch.
Middlesex Bleachery, . . . . .					1
North, Meriam & Co., . . . . .				1	
Boston and Lowell R. R. Co., . . . . .				2	
Sortwell & Co., . . . . .				1	
J. P. Squire & Co., . . . . .				1	
Charles E. Meyer & Co., . . . . .				1	
Cambridge Horse Nail Co., . . . . .				1	
New England Glass Co., . . . . .				1	
American Tube Works, . . . . .				1	
William Lincoln & Co., . . . . .			1		
Billings & Bulloch, . . . . .			1		
Welch, Bigelow & Co., . . . . .		1			
Commons Hall, . . . . .	1				
Shawmut Iron Works, . . . . .	1				

During the year the premises of each water-taker have been visited, and the examinations made have resulted in the correction of the rates to the advantage of the City.

Respectfully submitted,

A. F. FIFIELD,  
*Registrar.*

B.

# REPORT

OF THE

## SUPERINTENDENT OF THE WATER WORKS.

OFFICE OF THE WATER WORKS,  
City Hall, December 1, 1867.

*To the Cambridge Water Board:—*

GENTLEMEN,— In compliance with the ordinance providing for the care and management of the Cambridge Water Works, I herewith submit my

### ANNUAL REPORT.

The following is a statement of main and branch pipes laid, the streets through which laid, their size, length, &c., with all gates, stopcocks, waste-gates, and blow-off pipes, set since last report.

### LOCATION OF THE MAIN AND BRANCH PIPES.

STREETS	Size	Length
	Inches	Feet
Pumping main from Engine House to Reservoir, . . . . .	24	2,340
Dis-charge pipe from stand pipe to 24-inch gate in Reservoir Street, . . . . .	24	125
Cambridge Street and Broadway, from Kirkland Street to Court Street, . . . . .	20	10,072½
Court Street and Third Street, from Broadway to Bridge Street, . . . . .	12	3,915
Indian Street, Broadway to Harvard Street, . . . . .	12	492
Dock Street, from Broadway, . . . . .	6	129
Hancock Street, from Harvard to Centre Street, . . . . .	4	362
Centre Street, from Hancock to Dana Street, . . . . .	4	690
Dana Street, south from Centre Street, . . . . .	4	93

STREETS.		SIZE.	LENGTH
		Inches.	Feet.
Hampshire Street, extended west of Amory Street,		4	257
Forest Street, extended east,		4	379
Oxford Street, from Forest to Harris Street,		4	312
Harris Street, from Oxford,		4	172
Lowell Street, from Brattle Street,		4	668
Rice Street from North Avenue,		4	36
Allen Street, from North Avenue,		4	45
Ellery Street, from Cambridge Street,		4	215
Blackstone Street, to Riverside Press,		4	129
Welster Street, extended west,		4	170
Coggwell Avenue, from North Avenue,		4	53
North Avenue, opposite Milk, Hydrant Branch,		4	14
Arlington Street, Hydrant Branch,		4	18
Bowdoin Street, from Linnæan Street,		4	410
Concord Avenue, opposite Craigie Street, Hydrant Branch,		4	24
Pearl Street, extended to Green Street,		4	85
Green Street, from Pearl,		4	244
Warland Street, from Magazine Street,		4	402
Avon Street, to Shepard Street,		4	884
Shepard Street, from North Avenue,		4	780
Mehen " extended to Oxford Street,		4	437
Oxford " to Hammond Street,		4	85
Hammond " east from Oxford Street,		4	180
Antrim " from Cambridge Street,		4	148
Clinton " " Harvard " "		4	400
Short " " Magazine " "		4	390
Russell " " North Avenue,		4	755
One and First Street, in place of old pipe taken out,		4	440
Green Street, extended east,		4	292
Trowbridge Street, from Harvard Street,		4	236
Sparks " north from Brattle Street,		4	641
Amory " from Hampshire Street,		4	234
Channey " " North Avenue,		4	535
Park " " Magazine Street,		4	253
Prospect " " Cambridge to Hampshire Street,		4	500
Gore " " Lambert Street,		4	1,152
Trowbridge " " Broadway,		4	465
De Wolf " " Mount Auburn Street,		4	405
Elm " north from Broadway,		4	675
Broadway and Hampshire Street,		4	37
" opposite Tucker's, Hydrant Branch,		4	34
Brattle and Lowell Street, " "		4	18
Willow Street, from North Avenue,		4	91
Garden " opposite Bond, Hydrant Branch,		4	11
Quincy " from Broadway,		4	120
Prescott Street, " "		4	74
Ware " " "		4	63
Cambridge Street and " "		4	55
Elm " from " "		4	47
Dana " " "		4	75
Elsworth Avenue " " "		4	41
Lancock Street " " "		4	57
Myrtle " " "		4	39
Antrim " " "		4	54



STREETS.	Size.	Length.
	Inches.	Feet.
Amory Street, from Broadway, . . . . .	4	41
Tremont " " " . . . . .	4	44
Norfolk " " " . . . . .	4	38
Boardman " " " . . . . .	4	61
Pine " . . . . .	3	63
Spring " west from Seventh Street, . . . . .	3	139
Norfolk " extended to Harvard Street, . . . . .	3	57
Washington Street, extended to Norfolk Street, . . . . .	3	340
Stevens Court, . . . . .	3	213
Eighth Street, from Spring Street, . . . . .	3	93
Austin " extended to Norfolk Street, . . . . .	3	145
Gerry " from Mount Auburn " . . . . .	3	353
River " " Blackstone Street, . . . . .	3	375
Fourth " south from Winter Street, . . . . .	3	125
Fifth " extended to Thorndike Street, . . . . .	3	158
Thorndike Street, west from Seventh " . . . . .	3	132
Beech Avenue, from Webster Avenue, . . . . .	3	200
Hancock Street, . . . . .	3	45
Fayette " . . . . .	3	60
Norfolk " . . . . .	3	52

The following gates and stopcocks have been established in connection with the pipes laid the present year : —

STREETS.	NUMBER.	Size.
		Inches.
Broadway, near Inman Street, . . . . .	1	20
" " Davis " . . . . .	1	20
Davis Street and Broadway, . . . . .	1	12
Pumping main at Engine-House, . . . . .	2	12
Court Street at Canal, . . . . .	2	12
Third " near Cambridge Street, . . . . .	1	12
Broadway and Inman Street, . . . . .	1	12
Gore and Third Street, . . . . .	2	6
Cambridge and Third Street, . . . . .	1	6
Broadway and Moore " . . . . .	1	6
" " Dock " . . . . .	1	6
" " Court " . . . . .	1	6
" on reducer, at end of 20-inch pipe, . . . . .	1	6
Lowell and Brattle Street, . . . . .	1	4
Cambridge, near Bridge Street, . . . . .	1	4
North Avenue and Allen Street, . . . . .	1	4
" " Willow Street, . . . . .	1	4
" " Cogswell Avenue, . . . . .	1	4
" Hydrant Branch near Bridge, . . . . .	1	4
" and Arlington Street, . . . . .	1	4
Linnæan and Bowdoin Street, . . . . .	1	4
Garden, opposite Bond Street, Hydrant Branch, . . . . .	1	4
Magazine and Warland Street, . . . . .	1	4
Western Avenue and Auburn Street, . . . . .	1	4
River and Fremont Street, . . . . .	1	4
North Avenue and Shepard Street, . . . . .	1	4

STREETS.	NUMBER.	SIZE.
		Inches.
Harvard and Clinton Street, . . . . .	1	4
Magazine and Short " . . . . .	1	4
North Avenue and Russell Street, . . . . .	1	4
Harvard and Trowbridge " . . . . .	1	4
Hampshire and Prospect " . . . . .	1	4
North Avenue and Chauncy " . . . . .	1	4
Magazine and Park Street, . . . . .	1	4
Court, between Canal and Charles Street, . . . . .	6	4
Cambridge and Hampshire Street, . . . . .	1	4
Third and Charles Street, . . . . .	2	4
" " Vine Street, . . . . .	2	4
" " Spring Street, . . . . .	2	4
" " Thorndike Street, . . . . .	2	4
" " Winter Street, . . . . .	1	4
" " Otis Street, . . . . .	2	4
" " Bridge Street, . . . . .	1	4
Gore and Fifth Street, . . . . .	1	4
Harvard and Inman Street, . . . . .	3	4
" " Remington Street, . . . . .	1	4
Mount Auburn and De Wolf Street, . . . . .	1	4
Broadway and Cambridge Street, . . . . .	1	4
" " Quincy Street, . . . . .	1	4
" " Prescott Street, . . . . .	1	4
" " Ware Street, . . . . .	2	4
" " Trowbridge Street, . . . . .	2	4
" " Ellery Street, . . . . .	2	4
" " Dana Street, . . . . .	2	4
" " Ellsworth Avenue, . . . . .	1	4
" " New Street, . . . . .	1	4
" " Hancock Street, . . . . .	1	4
" " Lee Street, . . . . .	1	4
" " Fayette Street, . . . . .	1	4
" " Antrim Street, . . . . .	1	4
" " Inman Street, . . . . .	1	4
" " Amory Street, . . . . .	1	4
" " Prospect Street, . . . . .	2	4
" " Tremont Street, . . . . .	1	4
" " Norfolk Street, . . . . .	2	4
" " Elm Street, . . . . .	2	4
" " Columbia Street, . . . . .	2	4
" " Boardman Street, . . . . .	1	4
" " Windsor Street, . . . . .	2	4
" " Clark Street, . . . . .	2	4
" " Davis Street, . . . . .	1	4
" " Hampshire Street, . . . . .	1	4
" " Brewery Street, . . . . .	1	4
" opposite Tucker's, Hydrant Branch, . . . . .	1	4
" and Street east of Reservoir, . . . . .	1	4
" " " " Hannum's Lot, . . . . .	1	4
" " Pioneer Street, . . . . .	1	4
Norfolk and Main Street, . . . . .	1	3
" " Harvard Street, . . . . .	1	3
Fifth and Thorndike Street, . . . . .	1	3
Cambridge and Ellery Street, . . . . .	1	2

STREETS.	NUMBER	SIZE.
		Inches.
Cambridge and Antrim Street, . . . . .	1	2
Webster and Beech Avenue, . . . . .	1	2
Broadway and Quincy Street, . . . . .	1	2
"    Prescott Street, . . . . .	1	2
"    Maple Avenue, . . . . .	1	2
BLOW-OFF PIPES.		
Broadway and Cambridge Street, . . . . .	1	4
"    Antrim Street, . . . . .	1	4
Ellery Street, . . . . .	1	1 1/2
Green Street, . . . . .	1	1 1/2
Warland Street, . . . . .	1	1 1/2
Shepard Street, . . . . .	1	1 1/2
Antrim Street, . . . . .	1	1 1/2
Short Street, . . . . .	1	1 1/2
Gerry Street, . . . . .	1	1 1/2
Fourth Street, . . . . .	1	1 1/2
Trowbridge Street, . . . . .	1	1 1/2
Sparks Street, . . . . .	1	1 1/2
Amory Street, . . . . .	1	1 1/2
Chauncy Street, . . . . .	1	1 1/2
Park Street, . . . . .	1	1 1/2
Thorndike Street, . . . . .	1	1 1/2
Russell Street, . . . . .	1	1 1/2
Dock Street, . . . . .	1	1 1/2

LOCATION OF ALL MAIN AND BRANCH PIPES, GATES, STOP-  
COCKS, &c., LAID TO DECEMBER 1, 1867.

STREETS.	SIZE.	LENGTH.
	Inches.	Feet
From Engine-House to the Reservoir, . . . . .	24	2,340
Discharge pipe from stand pipe to 24-inch gate in Reservoir Street, . . . . .	24	125
From Reservoir through Highland, Appleton, Brattle, and Craigie, . . . . .	24	3,645
From Engine-House into the Pond, . . . . .	20	288
Duplicate, . . . . .	20	18
From Craigie through Concord Avenue to Cambridge, . . . . .	20	2,769
"    Cambridge through Broadway to Court, . . . . .	20	10,072 6
"    Engine-House to the Reservoir, . . . . .	12	2,300
"    the Reservoir through Brattle to Mason, . . . . .	12	3,650
"    Broadway through Court to Bridge, . . . . .	12	3,915
"    "    "    Inman to Harvard, . . . . .	12	492
"    Mason through Brattle to Harvard Square, . . . . .	10	11,780
"    Harvard Square through Harvard to Main, . . . . .	10	
"    "    through Main to Putnam, . . . . .	10	
"    Brattle    "    Mason to Garden, . . . . .	10	
"    Mason    "    Garden to Cambridge, . . . . .	10	
"    Garden    "    Cambridge to Columbia, . . . . .	10	

STREETS.	SIZE.	LENGTH.
	Inches.	Feet.
From Cambridge through Prospect, to Somerville line, .	10	400
“ Somerville line, through Prospect, to Glass Works (cement), . . . . .	10	1,000
From Concord Avenue, through Garden, Bond and Linnæan (cement), . . . . .	10	4,916.6
North Avenue, at Fitchburg Railroad Crossing, . . . . .	10	110.6
From Fitchburg Railroad Crossing, through North Avenue, to Beech (cement), . . . . .	8	736.8
From Putnam, through Main to Magazine, . . . . .	8	3,000
“ Columbia, through Cambridge, to Fifth, . . . . .	8	3,000
North Avenue, from Beech to Rice (cement), . . . . .	6	2,661.6
Main, from Magazine to Foundry, . . . . .	6	2,600
“ “ Foundry to junction of Broadway (cement), . . . . .	6	3,113.9
Walnut, from Pleasant, east, . . . . .	6	491
North Avenue, near Arlington, to connect with cement pipe, . . . . .	6	48.6
Harvard, from Main to Hancock, . . . . .	6	2,500
Cambridge, from Fifth to Bridge, . . . . .	6	2,000
From Mason, through Garden and Waterhouse, . . . . .	6	800
North Avenue, from Waterhouse to Arlington, . . . . .	6	3,265
From North Avenue, through Sacramento, Union, and Milk, to Middlesex Bleachery, . . . . .	6	3,790
Dock, from Broadway, . . . . .	6	129
Magazine, from Erie, north, . . . . .	6	846.6
Ash, “ Brattle to Gas Works, . . . . .	4	1,250
Auburn, “ River, east, . . . . .	4	567
Arlington, “ North Avenue, . . . . .	4	448
Allen, “ “ “ . . . . .	4	45
Avon, “ Linnæan to Shepard, . . . . .	4	884
Arlington, Hydrant Branch, . . . . .	4	18
Antrim, from Cambridge, . . . . .	4	148
“ “ Broadway, Hydrant Branch, . . . . .	4	54
Amory, “ Hampshire, . . . . .	4	234
Berkeley and Phillips Place, from Mason to Craigie, . . . . .	4	1,745
Brighton, from Brattle to Planing Mill, . . . . .	4	969
Broadway, “ Moore to Hampshire, . . . . .	4	800
Brookline, “ Main, south, . . . . .	4	1,828
Bridge, “ Craigie's Bridge to Somerville, . . . . .	4	3,369
Bowdoin, “ Linnæan, . . . . .	4	410
Broadway, junction of Hampshire, Hydrant Branch, . . . . .	4	37
“ opposite Tucker's Factory, “ “ . . . . .	4	34
Brattle, corner of Lowell, Hydrant Branch, . . . . .	4	13
Boardman, from Broadway, “ “ . . . . .	4	61
Blackstone, “ River to Riverside Press, . . . . .	4	129
Cambridge, junction of Broadway, Hydrant Branch, . . . . .	4	55
Clinton, from Harvard, . . . . .	4	400
Concord Avenue, opposite Craigie, Hydrant Branch, . . . . .	4	24
Cogswell Avenue, from North Avenue, . . . . .	4	53
Centre, from Hancock to Dana, . . . . .	4	690
Chauncy, from North Avenue, . . . . .	4	535
Chester, “ “ “ . . . . .	4	522.8
Craigie, “ Brattle to Buckingham (cement), . . . . .	4	352
Clark, “ Washington to Chaney's Factory, . . . . .	4	500
Cherry, “ Main to Harvard, . . . . .	4	1,150

## STREETS

	Size	Length
	Inches	Feet
Columbia, from Main to Washington,	4	775
" " Harvard to Worcester,	4	252
Danster, " Harvard Square (cement),	4	300
Dana, " Harvard, south,	4	196
" " Cambridge,	4	580
" " Centre, south,	4	93
" " Broadway,	4	75
Davis, " Harvard to Broadway,	4	100
De Wolf, " Mount Auburn,	4	405
Ellery, " Broadway, Hydrant Branch,	4	47
" " Cambridge,	4	215
Ellsworth Avenue from Broadway,	4	41
Eric, from Pearl to Magazine,	4	500
East, " North to Hall's Wharf,	4	250
Elm, " Broadway, north,	4	675
Forest from North Avenue (cement),	4	742 4
" extended east (iron),	4	579
Front, from Main,	4	400
Franklin, from Brookline to Pearl,	4	457
Fourth, " Cambridge to Spring,	4	898
" " Bridge south,	4	139
Fifth, " Thorn like, south (cement),	4	105
" " Cambridge to Winter,	4	450
Foundry, " Main to Osborn's Mill,	4	492
Fayette, " Broadway,	4	30
Green, " Pearl,	4	241
" " Putnam,	4	412
Gore, " Fourth, west,	4	2,612
Garden, opposite Bond, Hydrant Branch,	4	11
Hancock, from Broadway,	4	57
" " Harvard to Centre,	4	362
Hammond, " Oxford,	4	265
Harris, from Oxford,	4	172
Hastings, from Moore,	4	800
Holyoke, from South to Harvard,	4	709
Harvard, from Hancock to Columbia,	4	2,613 4
" " Cherry to Pioneer,	4	3,187 6
Hampshire, from Columbia to Amory,	4	1,510
Irving, from Cambridge, (cement),	4	321
Kirkland, from Cambridge to Sumner,	4	1,436
Lincoln, from Windsor,	4	290
Lee, from Main,	4	397
" " Harvard, north,	4	206
Leighton Court from East,	4	1,100
Lowell, from Brattle,	4	468
Mt. Auburn, from Ash, east,	4	700
" " Holyoke, east,	4	1,230
Market, from Union to Bristol,	4	550
Magazine, from Eric south,	4	187
Moore, from Harvard to Hastings,	4	220
Main from junction of Broadway, east,	4	1,300
Melton, from Oxford, east,	4	137
Milk Row, from Bleachery to Tube Works,	4	1,899
North Avenue, opposite Milk, Hydrant Branch	4	14





STREETS.		Size	Length
		Inches	Feet
Ware, from Broadway, Hydrant Branch,		4	63
Webster Avenue, from Prospect, south,		4	339
Austin, from Columbia to Norfolk,		3	653
" " Innan,		3	236
Appleton, from Brattle,		3	878
Auburn, " Pearl, east,		3	80
" " Auburn Court, east,		3	222
Allston, " Pearl, east,		3	178
Buckingham, from Craigie,		3	640
Broadway, " Columbia, east,		3	312
" " Pioneer to Skinner's Wharf,		3	901
" " Dana, east,		3	491
" " E. Raymond's, east,		3	90
Bristol, " Market, north,		3	250
Beech Avenue, from Webster Avenue,		3	200
Bolton, " Oak,		3	288
Clark, " Hampshire, north,		3	234
Columbia, " Washington to Worcester,		3	397
" " Harvard, north,		3	600
" " Cambridge,		3	598
Clinton, " Main,		3	578
Charles, " Third, west,		3	230
Dana, " Harvard to Broadway,		3	616
Distil-house, " Cambridge, north,		3	706
Eighth, " Spring,		3	93
Erie, " Pearl, east,		3	256
Essex, " Harvard, south,		3	1,036
Elm, " Hampshire, north,		3	225
Ellsworth Avenue, from Broadway,		3	920
Elery, from Main,		3	215
Fayette, " Broadway to Cambridge		3	1,383
Fifth, " Otis to Thorndike,		3	233
" " " north,		3	190
Fourth, " Winter, south,		3	125
Franklin, " Brookline, east,		3	108
Gerry, " Mount Auburn,		3	353
Hancock, " Harvard to Broadway,		3	493
Harvard, " Cherry to Boardman,		3	100
Harvard Square to Church,		3	332
Holyoke Place, from Holyoke,		3	220
Hampshire, " Clark, east,		3	113
Howard, " Mount Auburn,		3	272
Irving, " Kirkland, south,		3	515
Innan, " Main,		3	557
" " Cambridge,		3	697
Jay, " Western Avenue,		3	323
Kirkland, " Irving, west,		3	570
Kinnard, " River,		3	153
Lauren, " Harvard,		3	172
Market, " Union, west,		3	84
Maple Avenue, " Cambridge,		3	1,111
Magazine, from near Haddon to Magazine Court,		3	412
" " Court, from Magazine,		3	480
Mellen, from North Avenue,		3	489

STREETS.		SIZE.	LENGTH.
		Inches.	Feet.
Norfolk, from Main to Harvard,	.	3	1,307
" " Cambridge, north,	.	3	639
" " Broadway, "	.	3	172
Oak, " Prospect,	.	3	510
Pine, " School,	.	3	243
Pioneer, " Main to Broadway,	.	3	280
Passage-way, from Bristol and Clark Streets,	.	3	224
Quincy, from Harvard, north,	.	3	982
River " Blackstone, south,	.	3	375
Remington, from Main,	.	3	234
Spring, " Third, west,	.	3	383
Second, " Cambridge, north,	.	3	200
Seventh, " Thorndike, south,	.	3	135
Short, " North,	.	3	180
School Court, " Brattle,	.	3	200
Soden, " Western Avenue,	.	3	253
Story, " Brattle,	.	3	311
Sixth, " Otis, north,	.	3	181
Spring, " Seventh, west,	.	3	139
Stevens Court, from Fourth,	.	3	213
Temple, " Main,	.	3	190
Tremont, " Hampshire to Broadway,	.	3	1,050
" " Cambridge, north,	.	3	171
Third, " " south,	.	3	158
Trowbridge, " Harvard, north,	.	3	308
Thorndike, " Third, west,	.	3	383
" " Fourth, east,	.	3	93
" " Seventh, west,	.	3	132
Union, " Lincoln, south,	.	3	717
Vine, " Third, west,	.	3	383
Valentine, " Brookline,	.	3	240
Village, " Front,	.	3	353
Winter, " Fifth to Bridge,	.	3	900
Webster Avenue, from Somerville line, south,	.	3	1,030
Worcester, from Columbia to Norfolk,	.	3	444
William, " River, east,	.	3	647
Watson, " Pearl to Brookline,	.	3	522
Windsor, " Cambridge, north,	.	3	362
Washington, " Columbia to Norfolk,	.	3	495
Ware, " Harvard, north,	.	3	300
Winthrop, west from Winthrop Square,	.	3	78
Walnut Court, from Magazine Court to Walnut,	.	3	52



## GATES AND STOPCOCKS.

STREET.	NUMBER.	SIZE.
		Inches.
Near the Reservoir, . . . . .	3	24
Junction of Craigie and Concord Avenue, . . . . .	1	20
"    "    Cambridge and Kirkland, . . . . .	1	20
Broadway, at Inman, . . . . .	1	20
"    "    Davis, . . . . .	1	20
At the Reservoir, . . . . .	1	16
Broadway, at Davis, . . . . .	1	12
At Engine-house, on pumping main, . . . . .	4	12
Court, at Broad Canal, . . . . .	2	12
Third, near Cambridge, . . . . .	1	12
Broadway, at Inman, . . . . .	1	12
Highland, . . . . .	2	12
At the Reservoir, . . . . .	1	12
Concord Avenue, near Craigie, . . . . .	1	10
North Avenue, at Fitchburg Railroad Bridge, . . . . .	1	10
Cambridge, near Kirkland, . . . . .	1	10
Brattle and Mason, . . . . .	1	10
"    near the "University Press," . . . . .	1	10
Cambridge, at Prospect, . . . . .	1	10
"    near Columbia, . . . . .	1	8
Main, at Dana, . . . . .	1	8
North Avenue, at Beech, . . . . .	1	8
Gore, at Third, . . . . .	2	6
Cambridge, at Third, . . . . .	1	6
Broadway, at Moore, . . . . .	1	6
"    "    Dock, . . . . .	1	6
"    "    Court, . . . . .	1	6
"    on reducer, at end of 20-inch pipe, . . . . .	1	6
Cambridge, at Second, . . . . .	1	6
Harvard, near Ware, . . . . .	1	6
Main, at Columbia, . . . . .	1	6
Milk Row, at Bleachery, . . . . .	1	6
North Avenue, near Shepard, . . . . .	1	6
"    "    "    Sacramento, . . . . .	1	6
"    "    "    Rice, . . . . .	1	6
"    "    "    Arlington, . . . . .	1	6
"    "    "    Holmes Place, . . . . .	1	6
Concord Avenue, near Follen, . . . . .	1	6
Craigie, near the Culvert, . . . . .	1	6
Brattle, "    Sparks, . . . . .	1	6
Main, "    Foundry, . . . . .	1	6
"    at junction of Harvard, . . . . .	1	6
Waterhouse, at Concord Avenue, . . . . .	2	6
At the Reservoir, . . . . .	1	6
Brattle, at Ash, . . . . .	1	4
"    "    Brighton, . . . . .	1	4
"    "    Craigie, . . . . .	1	4
"    "    Palmer, . . . . .	1	4
"    "    Lowell, . . . . .	1	4
Broadway, at Trowbridge, . . . . .	2	4

STREET.		NUMBER.	SIZE.
			Inches.
Broadway, at Ellery,	.	2	4
" " Dana,	.	2	4
" " Ellsworth Avenue,	.	1	4
" " New Street,	.	1	4
" " Hancock,	.	1	4
" " Lee,	.	1	4
" " Fayette,	.	1	4
" " Antrim,	.	1	4
" " Inman,	.	1	4
" " Amory,	.	1	4
" " Prospect,	.	2	4
" " Tremont,	.	1	4
" " Norfolk,	.	2	4
" " Elm,	.	2	4
" " Columbia,	.	2	4
" " Boardman,	.	1	4
" " Windsor,	.	2	4
" " Clark,	.	2	4
" " Davis,	.	1	4
" " Hampshire,	.	1	4
" " Brewery,	.	1	4
" " Pioneer,	.	1	4
" " Cambridge,	.	1	4
" " Quincy,	.	1	4
" " Prescott,	.	1	4
" " Ware,	.	2	4
" opposite Tucker's, Hydrant Branch,	.	1	4
" at passage-way east of Brick Reservoir,	.	1	4
Broadway, at passage-way east of Hannum's Block,	.	1	4
Cambridge, at Dana,	.	1	4
" " Windsor, south,	.	1	4
" " Seventh,	"	1	4
" " Fifth,	.	1	4
" " Fourth,	.	1	4
" " Third,	.	1	4
" near junction of Bridge,	.	1	4
" junction of Hampshire,	.	1	4
Concord Avenue, near Craigie, Hydrant Branch,	.	1	4
Craigie, near the Culvert,	.	1	4
Columbia, at Washington,	.	1	4
Court, between Broad Canal, and Charles,	.	1	4
Garden, opposite Bond, Hydrant Branch,	.	1	4
Gore, at Fifth,	.	1	4
Harvard, at Lee,	.	1	4
" " Essex,	.	1	4
" " Main,	.	1	4
" " Clinton,	.	1	4
" " Trowbridge,	.	1	4
" " Inman,	.	3	4
" " Remington,	.	1	4
Harvard Square, at Dunster,	.	1	4
Hampshire, at Prospect,	.	1	4
Linnæan, near Avon,	.	1	4
" at Bowdoin,	.	1	4

STREET.	NUMBER.	SIZE.
		Inches.
Main, at Ellery, . . . . .	1	4
“ near Harvard, Ward Two, . . . . .	1	4
“ “ West Boston Bridge, . . . . .	1	4
“ at Brookline, . . . . .	1	4
“ “ Cherry, . . . . .	1	4
“ “ Prospect, . . . . .	1	4
“ “ Putnam, . . . . .	1	4
“ “ River, . . . . .	1	4
Mason, at Phillips Place, . . . . .	1	4
Magazine, near Erie, . . . . .	1	4
“ at Warland, . . . . .	1	4
“ “ Short, . . . . .	1	4
“ “ Park, . . . . .	1	4
Mt. Auburn, at Holyoke, . . . . .	1	4
“ “ “ De Wolf, . . . . .	1	4
Milk Row, near Tube Works, . . . . .	1	4
North Avenue, at Arlington, . . . . .	2	4
“ “ “ Wendell, . . . . .	1	4
“ “ “ Forest, . . . . .	1	4
“ “ “ Chester, . . . . .	1	4
“ “ “ Allen, . . . . .	1	4
“ “ “ Willow, . . . . .	1	4
“ “ “ Cogswell Avenue, . . . . .	1	4
“ “ near Fitchburg R. R. Bridge, . . . . .	1	4
“ “ at Shepard, . . . . .	1	4
“ “ “ Russell, . . . . .	1	4
“ “ “ Chauncy . . . . .	1	4
River, at Fremont, . . . . .	1	4
Third, “ Charles, . . . . .	2	4
“ “ Vine, . . . . .	2	4
“ “ Spring, . . . . .	2	4
“ “ Otis, . . . . .	2	4
“ “ Thorndike, . . . . .	2	4
“ “ Winter, . . . . .	1	4
“ “ Bridge, . . . . .	1	4
Western Avenue, at Auburn, . . . . .	1	4
Windsor, at Harvard, . . . . .	1	4
At Craigie's Bridge, . . . . .	1	3
Front, near Main, . . . . .	1	3
Fifth, at Thorndike, . . . . .	1	3
Norfolk, at Main, . . . . .	1	3
“ “ Harvard, . . . . .	1	3
Walnut, “ Walnut Court, . . . . .	1	3
Broadway, at Quincy, . . . . .	1	2
“ “ Prescott, . . . . .	1	2
“ “ Maple Avenue, . . . . .	1	2
Brattle, “ Story, . . . . .	1	2
“ “ Appleton, . . . . .	1	2
“ “ School Court, . . . . .	1	2
Brighton, “ Winthrop Place, . . . . .	1	2
Berkeley, “ Craigie, . . . . .	1	2
Cambridge, “ Ellery, . . . . .	1	2
“ “ Antrim, . . . . .	1	2
“ “ Sumner, . . . . .	1	2

STREET.	NUMBER.	SIZE.
		Inches.
Cambridge, at Irving, . . . . .	1	2
“ “ Maple Avenue, . . . . .	1	2
“ “ Fayette, . . . . .	1	2
“ “ Inman, . . . . .	1	2
“ “ Tremont, . . . . .	1	2
“ “ Norfolk, . . . . .	1	2
“ “ Windsor, . . . . .	1	2
“ “ Third, . . . . .	1	2
“ “ North Second, . . . . .	1	2
“ “ Distil-house, . . . . .	1	2
Columbia, at Worcester, . . . . .	1	2
Harvard, at Hancock, . . . . .	1	2
“ “ Trowbridge, . . . . .	1	2
“ “ Linden, . . . . .	1	2
“ “ Quincy, . . . . .	1	2
“ “ Ware, . . . . .	1	2
“ “ Dana, north, . . . . .	1	2
“ “ “ south, . . . . .	1	2
Holyoke, at Holyoke Place, . . . . .	1	2
Mt. Auburn, at Howard, . . . . .	1	2
Main, at Remington, . . . . .	1	2
“ “ Lee, . . . . .	1	2
“ “ Pleasant, . . . . .	1	2
“ “ Clinton, . . . . .	1	2
North Avenue, at Mellen, . . . . .	1	2
North, at East, . . . . .	1	2
Oak, “ Prospect, . . . . .	1	1½
Pearl, “ Auburn, . . . . .	1	2
“ “ Watson, . . . . .	1	2
Webster Avenue, at Beech Avenue, . . . . .	1	2
WASTE GATES.		
Broadway, at Cambridge, . . . . .	1	4
“ “ Antrim, . . . . .	1	4
Bridge, near Craigie's Bridge, . . . . .	1	3
Craigie “ the Culvert, . . . . .	1	6
Front, at Village, . . . . .	1	2
Gas-House Yard, . . . . .	1	3
Main, near West Boston Bridge, . . . . .	1	4
Osborn's Mill, . . . . .	1	2
BLOW-OFF PIPES.		
Arlington, . . . . .	1	1½
Auburn, near Pearl, . . . . .	1	1½
“ “ Brookline, . . . . .	1	1½
Antrim, . . . . .	1	1½
Amory, . . . . .	1	1½
Allston, . . . . .	1	1½
Broadway, near E. Raymond's, . . . . .	1	1½
“ “ Boardman, . . . . .	1	1½

STREET.	NUMBER	FEET.
		Inches
Buckingham, . . . . .	1	1
Brookline, near Auburn, . . . . .	1	1
Bridge, " E. Train's store, . . . . .	1	1
" " Leland Estate, . . . . .	1	1
Bolton, . . . . .	1	1
Berkeley, . . . . .	1	1
Brookline, near Erie, . . . . .	1	1
Chauncy, . . . . .	1	1
Columbia, north from Broadway, . . . . .	1	1
Chestnut Place, . . . . .	1	1
Columbia, north from Cambridge, . . . . .	1	1
Clark, near Hampshire, . . . . .	1	1
Charles, " Fourth, . . . . .	1	1
Chester, . . . . .	1	1
Dock, . . . . .	1	1
Dana, . . . . .	1	1
Ellery, north from Main, . . . . .	1	1
Elm, . . . . .	1	1
Erie, . . . . .	1	1
Essex, near J. G. Ball's, . . . . .	1	1
Ellsworth Avenue, near Cambridge, . . . . .	1	1
Ellery, south from Cambridge, . . . . .	1	1
Fourth, near William Casey's, . . . . .	1	1
" " D. Lohan's, . . . . .	1	1
Green, east from Putnam, . . . . .	1	1
Gerry, . . . . .	1	1
Green, west from Pearl, . . . . .	1	1
Howard, . . . . .	1	1
Hampshire, near Armory, . . . . .	1	1
" " Hugh Finnegan's, . . . . .	1	1
Hastings, . . . . .	1	1
Holyoke, . . . . .	1	1
Inman, north from Austin, . . . . .	1	1
" south " Hampshire, . . . . .	1	1
Kirkland, west from Irving, . . . . .	1	1
" east " Preston, . . . . .	1	1
Lincoln, . . . . .	1	1
Linden, . . . . .	1	1
Lee, near Captain Ryder's, . . . . .	1	1
" " West, . . . . .	1	1
Main, " Skinner's Wharf, . . . . .	1	1
Magazine, near Franklin, . . . . .	1	1
Maple Avenue, . . . . .	1	1
Market, . . . . .	1	1
Mount Auburn, near J. P. Thayer's, . . . . .	1	1
" " William L. Whitney's, . . . . .	1	1
Norfolk, near Webster Avenue, . . . . .	1	1
North Second, near Gore, . . . . .	1	1
North Avenue, at Rice, . . . . .	1	1
Park, . . . . .	1	1
Pine, . . . . .	1	1
Russell, . . . . .	1	1
Shepard, . . . . .	1	1
Short, . . . . .	1	1

STREET.	NUMBER.	SIZE.
		Inches.
Sparks, . . . . .	1	1½
Spring, east from Fourth, . . . . .	1	1½
“ west “ “ . . . . .	1	1½
“ near Rindge's Block, . . . . .	1	1½
Soden, “ the Laundry, . . . . .	1	1½
Story, . . . . .	1	1½
Sumner, . . . . .	1	1½
Sixth, near Cambridge, . . . . .	1	1½
Trowbridge, south from Harvard, . . . . .	1	1½
Thorndike, near E. Train's . . . . .	1	1½
“ east from Fourth, . . . . .	1	1½
“ west “ “ . . . . .	1	1½
Temple, . . . . .	1	1½
Third, near F. Siverliche's, . . . . .	1	1½
Union, “ Hampshire, . . . . .	1	1½
Valentine, . . . . .	1	1½
Village, near State, . . . . .	1	1½
Vine, near Fourth, . . . . .	1	1½
Wendell, . . . . .	1	1½
Warland, . . . . .	1	1½
Ware, . . . . .	1	1½
Washington, . . . . .	1	1½
Worcester, near Norfolk, . . . . .	1	1½
Webster Avenue, north from Cambridge, . . . . .	1	1½
Winthrop Place, . . . . .	1	1½
Western Avenue, near Howard, . . . . .	1	1½
William, . . . . .	1	1½

RECAPITULATION.

6,110	feet,	.	.	.	.	.	.	.	.	.	.	24-inch	iron	pipe.
13,147 <sup>6</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	20	"	"
10,357	"	.	.	.	.	.	.	.	.	.	.	12	"	"
12,290 <sup>6</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	10	"	"
5,916 <sup>6</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	10	"	cement
6,000	"	.	.	.	.	.	.	.	.	.	.	8	"	iron
736 <sup>8</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	8	"	cement
12,680	"	.	.	.	.	.	.	.	.	.	.	6	"	iron
9,565 <sup>3</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	6	"	cement
80,384 <sup>8</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	4	"	iron
4,463 <sup>4</sup> / <sub>12</sub>	"	.	.	.	.	.	.	.	.	.	.	4	"	cement
28,058	"	.	.	.	.	.	.	.	.	.	.	3	"	iron

WATER GATES.

3	.	.	.	.	.	.	.	.	.	.	.	.	.	24-inch.
4	.	.	.	.	.	.	.	.	.	.	.	.	.	20 "
1	.	.	.	.	.	.	.	.	.	.	.	.	.	16 "
12	.	.	.	.	.	.	.	.	.	.	.	.	.	12 "
6	.	.	.	.	.	.	.	.	.	.	.	.	.	10 "
3	.	.	.	.	.	.	.	.	.	.	.	.	.	8 "
24	.	.	.	.	.	.	.	.	.	.	.	.	.	6 "
115	.	.	.	.	.	.	.	.	.	.	.	.	.	4 "
5	.	.	.	.	.	.	.	.	.	.	.	.	.	3 "

STOP-COCKS.

40	.	.	.	.	.	.	.	.	.	.	.	.	.	2-inch.
1	.	.	.	.	.	.	.	.	.	.	.	.	.	1 <sup>1</sup> / <sub>2</sub> "

WASTE GATES.

1	.	.	.	.	.	.	.	.	.	.	.	.	.	6-inch.
3	.	.	.	.	.	.	.	.	.	.	.	.	.	4 "
2	.	.	.	.	.	.	.	.	.	.	.	.	.	3 "
2	.	.	.	.	.	.	.	.	.	.	.	.	.	2 "

BLOW-OFF PIPES.

89	.	.	.	.	.	.	.	.	.	.	.	.	.	1 <sup>1</sup> / <sub>2</sub> -inch.
----	---	---	---	---	---	---	---	---	---	---	---	---	---	--------------------------------------

The leak through the paving and embankment of the new Reservoir was repaired in April, the twelve-inch pipe removed from inside, and the bottom coated with cement mortar one inch thick; and the Reservoir, having been filled with water since the repairs shows no indications of leaking. The top course of granite coping has been placed on the wall. The outside wall of Reservoir and the coping require pointing to give a good finish. The fence between Mr. Little's land and that of the City has been built, enclosing the premises on that side of the Reservoir.

The expense at the Pond has been mostly for small repairs on the engines, and for grading the ground about the house built for the engineer and the engine-house. The engines were obliged to pump so constantly, and at such a rate, to keep up the supply of water in the Reservoir, before the main pipes were connected at the engine-house to enable both pumps to work together, that there were repairs to be made quite often, and at one time both engines were broken, and the pumping was stopped for several hours, causing considerable anxiety lest the supply of water in the Reservoirs should not be sufficient to last until the engine could be repaired and commence pumping again.

The Works are believed to be in good condition, as far as completed, and the pipes, being laid with lead joints, are less liable to leak and are more readily repaired than when made with cement.

Number of leaks in main pipes, 90, 84 of which were at the joints, one of which was caused by a pick in excavating, one by defective four-inch pipe.

Number of leaks in aqueduct log, 6. The log is in poor condition in many places, and the building and well-room under it will require repairing or to be rebuilt another season.

Number of leaks in supply pipes, 13.

10 supply pipes lowered to prevent freezing.

One 6-inch gate has been set on pipe at the Somerville Bleachery, one 3-inch gate, to replace one broken, for blow-off on Bridge Street, and one 3-inch gate near the Round House, on pipe purchased of the Union Sugar Refinery, in place of one broken.

Average number of gallons of water pumped daily the

past year, . . . . .	1,261,460
----------------------	-----------



Average number of gallons pumped to Reservoir for each	
hundred pounds of coal burned, . . . . .	62,100
Average daily increased consumption over last year, . . . . .	150,121
Average daily consumption for each taker, . . . . .	293

The supply pipes are increasing to such an extent, 248 having been laid since last report, making the number now laid 2,610, and the calls for small repairs are so numerous, that I believe it will be for the interest of the Water Board to have the takers employ plumbers for repairs on their premises when such repairs can be made without shutting off the water from main pipes.

Main pipe lowered in Western Avenue between Auburn and Howard Streets, and in Spring Street between Seventh and Eighth Streets.

8 new meters have been set during the year, making 14 now set, and at most of the places where they have been set the rates have increased, and in some places very largely, above the rates previously paid.

There have been set since last report 31 new hydrants, and one that was broken has been taken out and a new one put in its place, at the corner of River and Franklin Streets. Most of the new ones are set near the large main pipes, and will make a great addition to the facilities of the Fire Department in case of fires in their vicinities.

#### STATEMENT OF STOCK ON HAND PERTAINING TO CONSTRUCTION, EXCLUSIVE OF TOOLS.

439 plates annealed iron No. 9	30 × 81½	58,079
2 " " " " 11	36 × 68	152
		<hr/>
		58,231 lbs.

Value, at 6c., \$3,493.86.

7 . . . . .	24-inch cast-iron pipes.
7 . . . . .	20 " " "
72 . . . . .	12 " " "
3 . . . . .	10 " " "
4 . . . . .	8 " " "
40 . . . . .	6 " " "

46	.	.	.	.	.	4-inch cast-iron pipes.
11	.	.	.	.	.	3 " " "
2	.	.	.	.	.	24 " " 1-4 bends.
1	.	.	.	.	.	12 " " 1-4 "
6	.	.	.	.	.	4 " " 1-4 "
10	.	.	.	.	.	10 " " 1-8 "
1	.	.	.	.	.	24 × 20 inch cast-iron T.
1	.	.	.	.	.	24 × 16 " " "
1	.	.	.	.	.	24 × 6 " " "
3	.	.	.	.	.	12 " " "
1	.	.	.	.	.	10 × 6 " " "
1	.	.	.	.	.	10 × 4 " " "
3	.	.	.	.	.	6 " " "
2	.	.	.	.	.	6 × 4 " " "
5	.	.	.	.	.	4 " " "
2	.	.	.	.	.	3 " " "
1	.	.	.	.	.	20 × 6 inch cast-iron cross.
2	.	.	.	.	.	12 × 4 " " "
4	.	.	.	.	.	6 " " "
3	.	.	.	.	.	4 " " "
3	.	.	.	.	.	3 " " "
1	.	.	.	.	.	24-inch cast-iron sleeve.
3	.	.	.	.	.	12 " " "
3	.	.	.	.	.	10 " " "
3	.	.	.	.	.	8 " " "
5	.	.	.	.	.	6 " " "
8	.	.	.	.	.	4 " " "
4	.	.	.	.	.	3 " " "
1	.	.	.	.	.	24 × 10 inch cast-iron reducer.
2	.	.	.	.	.	6 × 4 " " "
1	.	.	.	.	.	4 × 3 " " "
11	.	.	.	.	.	4 inch cast-iron set-off pipes.
4	.	.	.	.	.	cast-iron hydrant frames and covers.
7	.	.	.	.	.	hydrants.
1	.	.	.	.	.	24-inch gate.
1	.	.	.	.	.	20 " "
1	.	.	.	.	.	16 " "
1	.	.	.	.	.	12 " "

1 . . . . 10-inch gate.

1 . . . . 8 " "

1 . . . . 6 " "

5 . . . . 4 " "

2 . . . . 3 " "

4,500 lbs. lead.

400 " hemp packing.

259 tons coal.

Respectfully submitted,

WM. H. PRATT,  
*Superintendent.*

C.

## REPORT

ON

### THE NEW PUMPING ENGINES.

---

CITY OF CAMBRIDGE,  
IN WATER BOARD, August 6, 1867.

THE Committee appointed to consider and report what Engines are most suitable for the enlargement of the pumping-power of the Cambridge Water Works, beg leave to

## REPORT

That they have given careful attention to the subject of a supply of water to our fast-growing City, whose constantly increasing demand for water is fast over-taxing our pumping-engines, — engines which are delivering more than double the quantity of water they were expected or guaranteed to supply, even after a constant service of more than ten years.

It has never been thought safe by any board or engineer to depend upon one engine to supply a city or town with water, as there must of necessity be many repairs and overhauls to keep them in order, if there should be no breakdowns that would require the stoppage of the pumps, and thereby cut off the supply of water.

We find our City is virtually in this condition, as the consumption is so great that one engine is unable to meet the wants of the City at the present time, although run at a truly dangerous

speed, which is also unprofitable as to the item of wear and tear, while the finality of the engines is much sooner reached.

In our present condition we have arranged to run both pumps at a slower rate, and while they are both running they can supply the City at the present time; but how much of the time both can be run is contingent, to such an extent as to be *absolutely unsafe*, where there is so great an interest dependent as the supplying of the City of Cambridge with water.

The well-room of our engines is not low enough to allow of a full supply to both engines, even when the water is as high as at the present time.

Your Committee believe that the Water Board are of one mind in regard to the necessity of providing increased pumping-power, as soon as it can be determined what is best to be done to furnish this increase; and they also believe that the City Council will grant any appropriation that may be requisite for the purpose of a judicious enlargement of the Works for the benefit of the citizens at large.

Before deciding upon so important a matter, your Committee thought best to examine the Steam Pumping Engines at Philadelphia, — where there are seven in all, of various forms of construction, and all using the stand-pipe, — and especially to ascertain the economy of the famous Cornish Engine, — of which there are three in Philadelphia, and it is proposed to erect two more, — and also to learn the difficulties of using a stand-pipe and the advantages of the same, if any should appear.

This latter object seemed very important at the present time, as we have already expended about twenty thousand dollars in almost completing a stand-pipe for our Works; and many grave doubts have been expressed by some who have been professionally employed in its construction and on other parts of the Works, which have passed current in the community as settled facts, to wit, "That the stand-pipe is a failure," "That it will never work," "That it was a most foolish expenditure of money," etc. These doubts have led many members of the City Council to question the wisdom of the Water Board in this expenditure, although it was advised by the distinguished water engineer from New Jersey, Mr. Bailey, who came here and examined the Works professionally soon after they became the property of the City,

and submitted several sketches and plans for its erection, one of which was adopted substantially by this Board, and the details of its construction were committed to a resident engineer, Mr. Chase, who has finished the work with the exception of about twenty-two feet of the stand-pipe and the corresponding overflow-pipe.

One of your Committee visited Philadelphia, and lost no time in putting himself in communication with the Chief Engineer of that city, Mr. Graff, who is considered one of the best engineers in the country. Mr. Graff accompanied him to the different works, and gave all the information desired in regard to the workings of the several engines and stand-pipes, and the economy of the Cornish Engine, and allowed him to take two of their monthly statements of all their works, from which we deduce the following comparative results of the Cornish Engine and those now in use at our Works:—

The Spring Garden beam Cornish Engine, with steam-cylinder 60 inches in diameter and 16 feet stroke, making 10 strokes per minute, on one end of beam, and on the other a pump with plunger 30 inches in diameter, 10 feet stroke, and heavy enough to balance a column of water 125 feet high in stand-pipe, shows the duty, taking the average of a month's work, to be 50,000 gallons raised 1 foot high with 1 pound coal.

The Kensington Works on the Delaware, with ordinary low-pressure engine, same size of cylinder, and same length stroke, working, with a bell-crank motion, a horizontal pump, raising water same height, taking same average, shows a duty of only 24,000 gallons raised 1 foot high with 1 pound coal.

Then taking the engines of our own Works, on a month's average, we find a duty of 52,500 gallons raised 1 foot high with 1 pound coal, being 2,500 gallons more raised 1 foot high with 1 pound coal than by the Cornish Engine, thereby establishing the economy of the engines we now have by a large balance in their favor.

The next question to be considered was the stand-pipe. We found each of the different works had a stand-pipe. At the Kensington Works the water in the stand-pipe averages 17 feet higher than that in the reservoir, two miles distant, into which the pipe empties. In such a case the stand-pipe acts as a re-

lief to the pumps, by allowing the water to rise up in the pipe with each pulsation of the pumps, when to move the water at varying velocity in a pipe two miles long would be impracticable, and consequently would overstrain the pumps and cause a loss of power.

The West Philadelphia Works have two Cornish Engines working into a stand-pipe without a reservoir, and are self-regulating, to a great extent, by the pressure of the water in the stand-pipe. A mercury-gauge shows any variation that may take place, and a telegraphic fire-alarm signal in the engine-house informs the engineer when an extra supply is wanted.

There is one great objection to this manner of supply, especially at these works, where the engines are so nearly connected that one cannot be repaired without stopping both, which prevents their being kept in proper order. The supply lasts but a very short time, and it has therefore been determined by the Philadelphia government to build a reservoir in connection with the stand-pipe, and put in two new Cornish Engines with 84-inch cylinders.

Enough was seen to convince us that we are right in the matter of a stand-pipe for our Works, and that it is the most practicable way of serving the high lands in our City, and giving a full supply to all parts that are now partially served, at the same time affording greater protection in case of fire. While we have no higher land on which we can build a reservoir, we can raise our head to any required height by means of this pipe.

The next question was, can the engines we now use be made to work into a stand-pipe and maintain a nearly constant head, with an ever-varying consumption? If this can be done, then we have the best plan yet devised for supplying our City with water. To ascertain this fact, your Committee waited on Mr. H. R. Worthington, the builder of our engines, and submitted to him a plan for regulating the motion of the engines by the pressure of the column of water in the stand-pipe. After due consideration, Mr. Worthington writes his views upon the subject, which letter is considered a part of this report.



"NEW YORK, July 24, 1867.

"MR. A. K. P. WELCH, Cambridge:—

"DEAR SIR,—Our study thus far seems to favor the plan you propose for a high service. It is especially interesting for the reason that it puts a water supply within reach of many places where the usual system is not applicable. In fact your own case illustrates its utility very plainly. Without it, I do not see how **your high places are to be reached.**

"It seems clear to me that a very satisfactory result can be reached, even if we fail to secure the exact regulation your plan contemplates; and I am willing to trust it far enough to guarantee the engines against damage or injury resulting from the high-service pipe.

"I know we can do well, and I am by no means sure that we cannot reach all you propose. If we do, it will certainly extend the area of my field, and I am ready to do my part.

"Truly yours,

"HENRY R. WORTHINGTON."

Your Committee have come to the conclusion to recommend for the enlargement of the Cambridge Water Works a Duplex Worthington Engine, like one of those at Charlestown, which is capable of raising 5,000,000 gallons in twenty-four hours, and that the same be placed at the end of the present engine-house so as to connect with the branch of the 24-inch main put in for that purpose; and that a deeper well room be made to such engine, and a conduit be constructed into deep water to supply the same; and that the work be commenced as soon as circumstances will allow.

All which is respectfully submitted,

A. K. P. WELCH, }  
SAML. SLOCUMB, } *Committee.*

Accepted, and the recommendations adopted.

Attest:

JUSTIN A. JACOBS, *Clerk.*



CITY OF CAMBRIDGE,  
IN WATER BOARD, December 13, 1867.

The Committee to whom were referred the propositions of the Duplex Rotary Pump and Steam-Engine Company, and of George F. Blake & Co., to furnish the additional pumping apparatus required for the Cambridge Water Works, have given such attention to the subject as the propositions seemed to demand.

The cost of their engines being much below the cost of the one recommended by your Committee, at first thought many persons would judge they should have been purchased. But there are matters to be considered of greater importance than the first cost of any piece of machinery, especially a steam pump,—the cost of running and repairs, the durability of the machine, and, above all, the  *Duty* (that is, the number of pounds raised one foot high with the consumption of one pound of coal).

The rotary engine and pump above referred to have a new form of revolving cams, fitting into each other and to the sides of the case nearly steam-tight. This engine is on the high-pressure principle. The pump is on the same principle as the engine, although the cams do not touch the sides of the case, which prevents the friction that would otherwise take place, but allows a large quantity of water to flow back, especially under one hundred feet head, which would greatly reduce the theoretical discharge.

There are no data from which the economy of this pump can be ascertained from actual experiment, but the results of the various engines and pumps, with such comparisons as will follow, are the reasons the Committee give for the conclusions they have reached.

The steam pump proposed by George F. Blake & Co. is probably the best direct-acting high-pressure pump for boiler feeders and where fuel is cheap, or where a pump is wanted for but a short time and the fuel is of no consequence in comparison with the interest of the money on first cost; but when large and permanent power is required, as for steamships, ferry-boats, factories, &c., low-pressure engines are used for economy of fuel, although

their first cost and weight are nearly double those of high-pressure engines of the same power.

The parties desiring to furnish these high-pressure engines do not claim that they are economical in fuel, or that they can even compete with an ordinary low-pressure engine, while the engines we now have are a combination of the high and low-pressure principles. The inner cylinder is high-pressure, and receives steam the full length of the stroke; the steam then exhausts into an outer low-pressure cylinder, to which is attached an apparatus for condensing all the steam on the opposite side of the piston, thus producing a vacuum equal to twenty-seven inches of mercury, which adds greatly to the power and economy of the engine, as will be seen by comparing the results of a test experiment made with the Cambridge engines at the request of James P. Kirkwood, Esq., Chief Engineer of the Brooklyn Water Works.

"New York, June 29, 1857.

"The undersigned, having tested the performance of a pumping engine erected at Cambridge, Massachusetts, for the Water Works at that place, by Mr. H. R. Worthington, herewith submit the result of that test, with the data from which it was deduced.

"As it appeared to be desirable that the conditions of the trial should approach as nearly as possible those of daily working practice, and the boilers not being the subject of exclusive test, it did not seem essential that the time necessary to raise steam in them should be ascertained, nor the fuel for that purpose noted. The fires, engine, and boilers were put into fair working condition and run until the furnaces required fuel: the amount of the fuel in them was then carefully estimated from measurement, the intensity of the fires closely observed, and the steam pressure noted, as also the level of the water in the boilers.

"The test was then commenced and continued for the time mentioned below, care being taken that the condition of the fires and pressure of steam should be as near as possible the same at the termination as at the commencement of the trial.

"The amount of load upon the pumps was ascertained from its area and carefully observed indications of an Ashcroft pressure-gauge placed upon the delivery pipe, an estimated addition being

made for the height the water was drawn and forced between the centre of the gauge and the surface of the water in the pump-well; the total pressure thus obtained being thirty-three pounds to the square inch.

"The total number of strokes made by the engine amounting to 33,678, was obtained from a counter placed upon it, and confirmed by the average of numerous counts made during the trial.

"The length of stroke of the plunger (the average of thirteen careful measurements) was two and one-sixth feet.

"The total coal consumed was 508.5 pounds. The duration of the test fourteen hours forty-six minutes.

"The data will then be as follows:—

"150.521 inches area  $\times$  33 pounds = 4,967.193 pounds load upon the plunger. 33,678 strokes  $\times$   $2\frac{1}{6}$  feet = 72,969 feet travelled by the plunger. Then  $\frac{4,967.193 \times 72,969}{508.5} \times 100 = 71,278,486$

pounds lifted 1 foot high with 100 pounds coal. Previous to the trial, the scales upon which the coal was weighed were placed in a permanent position, examined and sealed; a copy of the certificate of the sealer as to their correctness is appended hereto. The Ashcroft gauge used was tested by the manufacturers after the trial, and their certificate of the amount of its error is also attached. The correction of this error has of course been made in the data given.

"The pump was opened, the diameter of the plunger and its piston-rod measured, during which time the tightness of the delivery valves and plunger under pressure of the column of water was observed.

"The leakage was very small, that of the valves being just appreciable, of the plunger comparatively very little more.

"Effort was made to obtain a measurement of the Reservoir with a view of ascertaining, if possible, the amount of water actually delivered by the pump during stated periods; it was found, however, impracticable to arrive at any satisfactory result on account of the irregularity of the slope sides, the unknown vacancies behind the stone lining, the absorbent character of the embankment, and the probable leakage of a reservoir of that size and description.

"The pumping main is brought up perpendicularly above the

surface of the water in the Reservoir, which admits of its being seen. Observation satisfied us that the water was delivered from it with great regularity, and did not contain any undue amount of air.

"The clothing of the steam pipes and cylinders, although good, is not as strictly guarded in that respect as is usual with the Cornish Engines in England. During the experiment the gauges were so placed as to afford an accurate indication of frictional resistances, showing that a head of 6.05 feet was required to overcome the friction of the water through the pump and main; in other words, the difference between the surveyed height and that indicated by the gauge was 6.05 feet.

"The general character of the design and workmanship of the engines is quite creditable, and they appear to be simple, reliable, and durable. During the trial everything worked satisfactorily, and required very little attention from the engineer.

"(Signed,)

"FREDERICK GRAFF,  
ERASTUS W. SMITH.

"To JAMES P. KIRKWOOD, Esq.,  
*Chief Engineer Brooklyn Water Works Co.*"

From the above report we learn what the engines now in use at our Works are capable of doing, and it is not uninteresting to compare the duty of these engines with that of others.

As some persons have tried to impress upon the public mind that a Cornish Engine known as the "Bull Engine," which has its steam cylinder directly over the water cylinder, and has no walking beam like the usual style Cornish, should have been adopted by this Board. This engine costs much more than the one adopted, and the duty is as follows, — as seen by Mr. Burkenbine's Report, 1866, page 26. (Mr. Burkenbine was then Engineer of the city of Philadelphia, and is the patentee of this style of Engine, which raised, with 100 pounds coal, 46,348,900 pounds 1 foot high.)

Our engines raised, with 100 pounds coal, 71,278,486 pounds.  
Balance in favor of Cambridge Engines, 24,929,586 pounds.

"Bull Engine," again, as per Report 1867, page 28, raised, with 100 pounds coal, 49,653,090 pounds 1 foot high. Balance in favor of Cambridge, 21,625,396 pounds.



Then take the Report on the Schuylkill Works, 1866, page 21, and we find that 100 pounds coal raised 38,649,100 pounds 1 foot high. Balance in favor of Cambridge, 32,629,386 pounds—nearly double the duty.

Then turning to Report of 1866, page 22, on the Delaware Works, we find that 100 pounds coal raised only 19,954,100 pounds, while the Cambridge engines raised 71,278,486 pounds 1 foot high. Balance in favor of Cambridge, 51,324,386 pounds.

We will now look at the reported duty of the Duplex Worthington Engine recommended by your Committee for our Works, which is a great improvement on those now in use here, and has proved to be the best pumping engine in this country. By the Report for 1865 on the Charlestown Water Works, — where two of these engines of 5,000,000 gallons' capacity each are in use alternately, — which must be considered as correct as those of Philadelphia, we find a duty of 77,444,500 pounds raised 1 foot high with 100 pounds coal on a year's average ( $= 96,805$  gallons water raised 1 foot high with 1 pound coal), which gives a balance in favor of the Duplex at Charlestown over the "Bull Engines," of 31,095,600 pounds raised 1 foot high for each 100 pounds coal consumed.

The Charlestown Report of 1866 shows a yearly average duty of 69,579,100 pounds raised 1 foot high with 100 pounds coal.

### THE COST OF ENGINES, ETC.

The foundations of the Jersey City Works with Cornish Engine cost more than the foundations and pumps at the Charlestown Works and are of *less capacity*.

The engines cost	\$70,000.00
Stand-pipe, engine-house, and foundation	80,000.00
Total	\$150,000.00

The same engines will now cost at least \$100,00.

A Cornish Engine cost in Philadelphia, sixteen years ago, without foundations and fixtures, \$60,000.

The Duplex Worthington Engine recommended by your Committee, with a capacity of 5,000,000 gallons in twenty-four hours, together with boilers, pipes, and foundation complete, and running to the satisfaction of the Water Board, will cost \$40,000.

### COST OF RUNNING ENGINES, FOR ATTENDANCE, ETC.

The 24th Ward, Philadelphia, Bull Engines, two in number, raised a daily average in 1866 of 1,468,283 gallons.

Salaries of engineers and firemen . . . . .	\$4,400.00
Repairs . . . . .	1,652.27
Duplex Engine at Charlestown, with a capacity of 5,000,000 gallons, cost for engineers and firemen .	\$2,562.50
Repairs . . . . .	None.

### COST OF SUPPLYING SEVERAL CITIES WITH WATER.

Croton Works, first cost . . . . .	\$12,000,000.00
Each million gallons' capacity . . . . .	300,000.00
Cochituate Works, first cost . . . . .	5,200,000.00
Each million gallons' capacity . . . . .	325,000.00
Cambridge Works, first cost . . . . .	250,000.00
Each million gallons' capacity . . . . .	166,666.00
Cost of the Works with the new pumps, about	580,000.00
Each million gallons' capacity . . . . .	90,000.00

### COST OF PUMPING WATER BY STEAM IN SEVERAL CITIES.

Buffalo, Bull Cornish Engine, . . . . .	\$17.35 per million gallons.
24th Ward, Philadelphia, Bull Cornish Engine, . . . . .	23.73 " " "
Cambridge, Worthington Engine, . . . . .	13.70 " " "

The cost of coal is from \$1.75 to \$3.00 per ton higher in Cambridge than in Philadelphia.

• Your Committee have given the foregoing data, thinking they might be of interest to those desiring to learn on what ground the Committee based their report which recommended the adoption of the Duplex Engine in preference to the much cheaper kinds offered, and also to show the cost of other Water Works as compared with our own, as well as the cost of working the same.

All which is respectfully submitted,

A. K. P. WELCH, }  
SAML. SLOCOMB, } *Committee.*







City of Cambridge.

4 ANNUAL REPORT 32023

OF

THE WATER BOARD

TO

THE CITY COUNCIL,

FOR THE YEAR 1868.



CAMBRIDGE:

Printed at the Riverside Press

1869.



City of Cambridge.

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ANNUAL REPORT

OF

THE WATER BOARD

TO

THE CITY COUNCIL,

FOR THE YEAR 1868.



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☆ CAMBRIDGE PUB. LIBRY



# REPORT

OF THE

## CAMBRIDGE WATER BOARD.

In obedience to the requirements of an ordinance of the City, the Cambridge Water Board have the honor to lay before the City Council their fourth

### ANNUAL REPORT,

Presenting a statement of the progress of the works during the past year, their present condition, with a statement of the receipts and expenditures, which gives strong assurance that, notwithstanding the great outlay at the Engine-house and at the Reservoir during the year, the increase of water-rates from additional water taken will be sufficient to meet the increased expenses and interest for the coming year.

The net cost of the Works, December 1, 1867, was	\$532,273.64
Expended for construction the past year . . . . .	160,496.38
Interest on water debt . . . . .	37,014.00

Total . . . . .	\$729,784.02
Deduct excess of income over expense . . . . .	55,535.35

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Net cost of the Works, December 1, 1868 .	\$674,248.67
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Receipts from water-rates for the year ending December 1, 1868 . . . . .	\$63,747.42
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Receipts from water-rates for the year ending December 1, 1867 . . . . .	52,733.62
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Increase of water-rates . . . . .	\$11,013.80
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Receipts from all sources for the year ending December 1, 1868 . . . . .	\$79,434.56
Receipts from all sources for the year ending December 1, 1867 . . . . .	66,040.66
	<hr/>
Increase of receipts in 1868 . . . . .	\$13,393.90

For a more detailed statement of the financial account of the Water Works, reference may be had to the Report of the Water Registrar, hereunto annexed.

The sinking fund established for the redemption of the Water Debt amounted on the first day of December, 1868, to \$24,463.38. In extending the work the present year we have laid of

36-inch pipe . . . . .	312 feet.
24-inch pipe . . . . .	45 feet.
20-inch pipe . . . . .	135 feet.
16-inch pipe . . . . .	125 feet.
12-inch pipe . . . . .	4,716 feet.
6-inch pipe . . . . .	9,572 feet.
4-inch pipe . . . . .	16,186 feet.
3-inch pipe . . . . .	2,324 feet.

Total amount of pipe laid, 33,415 feet, or more than six miles, making the whole length of pipe now laid about forty-three miles.

The Board have continued the practice of placing meters upon all large supplies, and the result has been highly favorable to the City. Fifteen new meters have been set the present year, increasing the number now in use to twenty-seven. Twenty new fire hydrants have been set, and the pipe in River Street has been lowered for about 1800 feet. 507 supply pipes have been put in, giving an increase of water-rates of \$11,013.80, a sum more than sufficient to pay the interest on the entire expenditures of the year.

For a more definite statement of the location of the pipe, and for a full description of all branches of the work of the present year, we would refer you to the accompanying Report of the Superintendent, hereunto annexed.

During the past year important improvements, and very great enlargement of the Works, have been made. The old reservoir, which was in a very bad condition and thought to be unsafe, has

been rebuilt substantially. A retaining wall has been extended entirely around it, uniform with that around the new one. To do this the reservoir was made much wider and higher, and therefore of much greater capacity. The reservoirs have been finished according to the plan adopted by the Board, drawn by the City Engineer.

An overflow pipe has been placed in the partition wall of 20 inches in diameter, opening into a chamber from which a 12-inch pipe is laid to each of the reservoirs below low-water level, so that they will not be liable to freeze up during the cold weather.

This overflow pipe within the chamber above referred to has, below the partition wall, an opening for each reservoir which can be used so that there will be no danger of overflowing one reservoir while the other is being cleaned. The overflow chamber is partitioned so that the water from one reservoir will not pass into the other.

The top of the overflow pipe is placed far enough below the top of the coping of the reservoirs to carry away any surplus water that will probably be pumped, and prevent the overflowing of the reservoirs at any time, and the washing of the banks.

The coping to the new reservoir has been relaid on a bedding of concrete, it having settled out of level by reason of the banks yielding, as all new earthwork is liable to do.

With the old reservoir completed, the whole presents one of the finest pieces of engineering and mason-work to be found in the country.

The stand-pipe, about which there have been so many grave doubts, has been finished, and the City has been supplied for many months entirely through it. It was found necessary, in order to relay the coping to the new reservoir and complete the old, that the supply should be furnished independent of the reservoirs, and the committee charged with the duty of completing the Works found it necessary to complete the stand-pipe. The result proved highly satisfactory to the Board. For more than four months the City has been supplied through the stand-pipe, furnishing water plentifully to the highest houses, while the head has been raised from 17 to 25 feet above the former head in the reservoirs, proving conclusively the utility of the stand-pipe to meet the wants of the water-takers.



The stand-pipe is also a perfect regulator of the quantity of water pumped. The head of water in the stand-pipe being uniform, the pumps run with a uniform speed ; but an increased head produces an increased resistance on the pumps, causing them to run slower, and therefore less water is pumped, while a greater consumption reduces the head, and therefore the resistance, and a greater quantity of water is pumped.

The reservoirs completed are worthy of the City, and with the graveled walk around them, and the beautiful sodded banks and stone steps for their approach, may well challenge an equal in the whole country. Should the water in the stand-pipe freeze to any considerable thickness, the pumps would have no relief, but would be pumping into the street mains ; therefore it was deemed expedient that the stand-pipe should be protected. Accordingly, a house, or tower, has been erected over it in the form of a column, much higher than the stand-pipe, in order to present a symmetrical appearance, and at the same time provide for increasing the height of the stand-pipe, should it ever be desired.

The first ten feet of the casing have been made of brick, surmounted with a granite moulding that matches the foundation. The rest of the house is constructed of wood, with a circular staircase within and around the stand-pipe to the look-out upon the top.

The casing to the stand-pipe will do the double duty of protecting the water from frost, and of affording our citizens, and strangers who may visit us, the best view of the surrounding country to be had in the vicinity.

No doubt the supply of the City will be furnished through the stand-pipe generally, but there will always be some contingencies to be provided for, such as the breaking or repairing of pumps and boilers ; therefore it is of the utmost importance to have reservoirs of sufficient capacity to supply the City for several days, while repairs are making.

As now arranged, a check valve placed in the pipe leading from the reservoirs closes when the water rises in the stand-pipe, and allows the City to be supplied with a greater head of water. But when the pumps stop, or fail to furnish the increased head, the valve opens, and the water runs from the reservoir, thereby furnishing a constant supply, but at a lower head. As a reservoir is its true office, and it should be kept merely as a *reserve*.

The City Engineer, Mr. Josiah G. Chase, has the past season been of much service on the works. He has at all times shown himself able and obliging. The committee in charge of the Works placed the completion of the reservoir work in the hands of Mr. Chase, who acted as superintendent as well as engineer of that particular work, under their direction. He prosecuted the work with much zeal, and barely completed the earthwork before the freezing of the ground.

The retaining wall built around the reservoir has settled a little in two places, but appears to have reached a firm bearing. It has shown no signs of settling for some weeks, and no fears are entertained by the Board in regard to it, as it is amply strong for the purpose intended. Some little finishing up upon the reservoirs will be required in the spring; when done, there will be no further expenditure needed upon them, we trust, for many years.

At the pond there have been erected a coal-shed, an engine, and a boiler-house, for the engine contracted for last year with Mr. H. R. Worthington, and the grounds have been inclosed with a substantial picket fence.

It was found necessary, in order to put in the foundations to the new engine and boiler-houses, first to make a coffer-dam around the whole work, which was done with as little expense as possible, with three-inch sheet-piling. In order to pump out the water within the dam it was thought best to purchase a small steam-engine and a rotary pump. This proved to be a wise conclusion, as the removing of water was much more of a problem than at first considered.

In the excavation for the foundations for a well-room and the engine, we struck quicksand, which at one time seemed to baffle all efforts to confine it; but with great quantities of hydraulic concrete, and indomitable perseverance, solid foundations were finally obtained, which we trust will last as long as they may be required.

The house for the new engine is much higher than the one for the small engines; it was built from plans furnished by Mr. Worthington, and presents a fine appearance from any point of view. The screen-rooms, which heretofore were exposed to freezing and impurities, have been inclosed in substantial brick houses, protecting them as well as rendering them easy of access at all times, and furnishing room for a repair shop.

The new engine built under contract with Mr. H. R. Worthington, of New York City, for the sum of \$40,000, has been put in place, the boilers set, and the machine put in motion, but it is not accepted by the Board at the present time. Its capacity is 5,000,000 gallons in twenty-four hours, and the Board have no doubt it will prove entirely satisfactory.

Although the contract specified that it should be delivered in June last, we were not ready to receive it much before it was delivered. The foul weather in the early part of the season, and the many difficulties encountered in putting in the foundation, delayed the completion of the engine-house for its reception much beyond the time specified.

The consumption of water by the City at the present time is about two million gallons per day of twenty-four hours, about the entire capacity of both the old pumps run all the time, — an increase during the year of 700,000 gallons; and we can congratulate the City, in view of this increasing consumption, that the new engine of more than double their capacity is now nearly ready for use. For it is apparent to all who have carefully considered the increasing consumption, that the old engines would be unable to supply the City during the winter months, when more water is consumed than during the summer.

The rapid increase of water-takers, and consequent consumption of water, admonish us that early measures should be taken to secure the water of Spy Pond, as provided for in the charter establishing the Cambridge Water Works.

Should the water of that pond be held for the use of the City, we may have little fears for a supply for many years to come. What is the capacity of Fresh Pond? some may well ask. In reply, we can only say that we have been unable to produce any perceptible reduction with the greatest draft of water made with our pumps.

Combining all the pumping power, we shall be able to deliver about 7,500,000 gallons daily, provided there should be no breaking down of any of the machinery; but it will be readily seen that we must have in reserve almost the same pumping power as we use, to be entirely safe from accident.

It is believed that the Works, as now constructed, are just what the City needs, and that the cost of the same, according to

their capacity, is below the cost of those of any other city in the Union.

Very little will have to be expended for many years upon the works, other than extending the street mains as the citizens may desire ; and it appears to the Board that they are now placed upon a secure foundation and will bring to the City greater returns upon the investment than heretofore.

All which is respectfully submitted.

JOHN SARGENT,  
CHARLES H. SAUNDERS,  
ROBERT DOUGLASS,  
C. W. KINGSLEY,  
A. K. P. WELCH,  
SAMUEL SLOCOMB,  
HENRY W. MUZZEY.

} *Cambridge  
Water Board.*

# REPORT

OF

## THE WATER REGISTRAR.

WATER REGISTRAR'S OFFICE, }  
CAMBRIDGE, December 1, 1868. }

*To the Cambridge Water Board: —*

GENTLEMEN, — In compliance with the provisions of the ordinance for the care and management of the Cambridge Water Works, the undersigned respectfully presents his Annual Report for the year ending November 30, 1868.

### Receipts.

The total amount of water-rates received for the year ending November 30, 1868, was . . . . .	\$63,747.42
Cash received on supply account for pipe, laying, repairing, etc. . . . .	13,315.43
Cash received for sheet iron sold . . . . .	1,846.45
Cash received from Engineer for rent of house . . . . .	225.00
Cash received for pasturage on land in Somerville . . . . .	12.00
Cash received for old iron, coal, etc., sold . . . . .	243.26
Cash received for horse and wagon sold . . . . .	45.00
—	
Total cash receipts from all sources . . . . .	\$79,434.56
All of which has been paid into the City Treasury.	

### Expenditures.

The expenditures for the care and management of the Works for the year ending November 30, 1868, have been as follows: —

For care and repairs . . . . .	\$7,655.83
For pumping service . . . . .	6,204.73
For office expenses . . . . .	2,648.29
—	
Total amount . . . . .	\$16,508.85



The expenditure on the extension of the Works for the year ending November 30, 1868, was . . .	\$160,496.38
The expenditure on supply account for the year end- ing November 30, 1868, was . . . . .	\$13,461.91
Received for water-rates for the year ending Novem- ber 30, 1868 . . . . .	\$63,747.42
Expended for the care and management of the Works	16,508.85
<hr/>	
Balance in favor of the Works . . . . .	\$47,238.57

## Supply Account.

Cash received on above account . . . . .	\$13,315.43
Now due . . . . .	5,314.55
	<hr/>
	\$18,629.98
There was reported as due December 1, 1867 . . . . .	\$2,458.58
Since expended . . . . .	13,461.91
	<hr/>
	15,920.49
<hr/>	
Balance in favor of account . . . . .	\$2,709.49

During the year the water has been turned off for non-payment of rates twenty-three times. Of this number, twenty have been let on, leaving a balance of three still remaining off.

Five hundred and seven supply pipes have been laid since December 1, 1867, supplying —

663 Families.
21 Stables.
5 Manufactories.
15 Stores and Offices.
12 Hand Hose.
3 Churches.
3 School-houses.
3 Saloons.
2 Carriage Manufactories.
1 Garden.
1 Soap Manufactory.
1 Lead Pipe Manufactory.
1 Boarding-house.

## WATER WORKS.

- 1 Fire Engine House.
- 1 Rolling Mill.
- 1 Skating Rink.

Increasing the rates, when all in use, about . \$3,500.00

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, ETC.,  
SUPPLIED WITH FRESH-POND WATER TO DECEMBER 1, 1868.

- 4,102 Families.
- 285 Stables.
- 198 Hand Hose.
- 140 Fire Hydrants.
- 118 Stores and Offices.
- 66 Stationary Engines.
- 82 Boarding-houses.
- 17 School-houses.
- 16 Meat Markets.
- 14 Soap Factories.
- 12 Bakeries.
- 14 Saloons and Victualing Houses.
- 14 Barber Shops.
- 10 Machine Shops.
- 10 Blacksmith Shops.
- 9 Furniture Manufactories.
- 8 Green-houses.
- 8 Churches.
- 6 Book-binderies.
- 6 Livery Stables.
- 6 Billiard Halls.
- 5 Printing Offices.
- 5 Fish Markets.
- 5 Planing Mills.
- 5 Iron Foundries.
- 5 Public Halls.
- 5 Fire Engine Houses.
- 5 Banks.
- 4 Glass Manufactories.

- 4 Photograph Rooms.**
- 4 Horse-railroad Stables.**
- 3 Public Houses.**
- 3 Slaughter Houses.**
- 3 Stone Yards.**
- 3 Post-offices.**
- 3 Police Stations.**
- 3 Carriage Manufactories.**
- 3 Fountains.**
- 3 Oil Factories.**
- 3 Laboratories.**
- 2 Club Stables.**
- 2 Club Rooms.**
- 2 Cattle Yards.**
- 2 Cow Pastures.**
- 2 Paint Shops.**
- 2 Brush Manufactories.**
- 2 Cooper Shops.**
- 2 Tin Ware Manufactories.**
- 2 Tallow Manufactories.**
- 2 Bacon Works.**
- 2 Cigar Manufactories.**
- 2 Currier Shops.**
- 2 Stereotype Foundries.**
- 2 Chemical Works.**
- 2 Boiler Manufactories.**
- 1 Rolling Mill.**
- 1 Tube Works.**
- 1 Bleachery.**
- 1 Coffin Manufactory.**
- 1 House of Correction.**
- 1 Lard Works.**
- 1 Steam Railroad.**
- 1 Nursery.**
- 1 Distillery.**
- 1 Brewery.**
- 1 Laundry.**
- 1 University.**
- 1 City Hall.**



- 1 Gymnasium.
- 1 Gas Works.
- 1 Steam Tug.
- 1 Lead Pipe Manufactory.
- 1 Church Organ Manufactory.
- 1 Piano Forte Manufactory.
- 1 Marble Works.
- 1 Car Manufactory.
- 1 Reversible Paper Collar Co.
- 1 Skating Rink.
- 1 Tobacco Soap Manufactory.
- 1 Sausage Manufactory.

During the year fifteen meters have been applied to the premises of water-takers, and in almost every case the rates have largely increased. The more general use of meters in manufacturing establishments would be undoubtedly of great advantage to the City in increasing the income and checking the waste.

### STATEMENT

SHOWING THE NUMBER AND SIZES OF METERS IN USE, DECEMBER 1, 1868

	SIZE OF METERS.					
	$\frac{1}{2}$ inch	$\frac{3}{4}$ inch	1 inch	1 $\frac{1}{2}$ inch	2 inch	4 inch
Middlesex Bleachery . . . . .	-	-	-	-	-	1
North, Meriam, & Co. . . . .	-	-	-	-	1	-
Boston and Lowell Railroad Co. . . . .	-	-	1	-	3	-
Leon Goodall & Co. . . . .	-	-	-	-	1	-
J. P. Squire & Co. . . . .	-	-	-	-	1	-
Beal & Hooper . . . . .	-	-	-	-	1	-
New England Glass Co. . . . .	-	-	-	-	1	-
American Tube Works . . . . .	-	-	-	-	1	-
Billings & Bullock . . . . .	-	-	1	-	-	-
Welch, Bigelow, & Co. . . . .	-	1	-	-	-	-
Commons Hall . . . . .	1	-	-	-	-	-
Shawmut Iron Works . . . . .	1	-	-	-	-	-
Bowman, Grant, & Co. . . . .	-	-	1	-	-	-
H. O. Houghton & Co. . . . .	-	-	-	-	1	-
Cambridge Laundry . . . . .	-	-	1	-	-	-
Tobacco Soap Manufacturing Co. . . . .	-	-	1	-	-	-
Broadway Glass Works . . . . .	-	-	-	1	-	-
John A. Ellis & Co. . . . .	-	-	-	1	-	-
House of Correction . . . . .	-	-	-	-	1	-
Union Glass Works . . . . .	-	-	2	-	-	-
Boston Chemical Works . . . . .	-	-	-	-	1	-
C. L. Jones & Co. . . . .	-	-	1	-	-	-
Boston Rolling Mill . . . . .	-	-	-	-	1	-

In the early part of the year the premises of each water-taker were visited, and the examinations made were beneficial to the City, as in many places during the winter months there is a great liability of waste from carelessness, or by the fixtures being out of order.

Respectfully submitted,

A. F. FIFIELD,  
*Registrar.*

# REPORT

## OF THE

### SUPERINTENDENT OF THE WATER WORKS.

*To the Cambridge Water Board: —*

GENTLEMEN, — In compliance with the ordinance providing for the care and management of the Cambridge Water Works, I herewith submit my Annual Report. The following is a statement of main and branch pipes laid, their size, length, and location, together with all gates, stop-cocks, waste-gates, and blow-off pipes set since my last Report in the following streets: —

STREETS	SIZE	LENGTH.
	Inches.	Feet
Austin Street, Prospect to Essex Street . . . . .	4	289
Austin Street, Prospect Street west to 3-inch pipe . . . .	4	325
Appian Way, Garden to Brattle Street . . . . .	4	549
Allston Street, extended east of Pearl Street . . . . .	4	90
Blackstone Street, extended north . . . . .	4	429
Brooks Street, from Magazine Street . . . . .	4	245
Bay Street, from Franklin Street . . . . .	4	50
Columbia Street, extended south to Webster Avenue . . . .	3	338
Columbia Street, extended north at Conlan's . . . . .	3	136
Columbia Street, Court at Conlan's . . . . .	3	170
Charles River Street, from Mount Auburn Street . . . . .	4	350
Copperthwaite Street, from De Wolf Street . . . . .	4	369
Cogswell Avenue, extended . . . . .	4	890
Cottage Street, Pleasant to Pearl Street . . . . .	6	997
Charles Street, Court to Fifth Street . . . . .	6	780
Court Street, Broadway to Main Street . . . . .	6	128
Davis Street, Broadway to Hampshire Street . . . . .	12	242
Dana Street, Harvard to Centre Street . . . . .	6	333
Day Street, from North Avenue . . . . .	4	576

STREETS.	SIZE		LENGTH
	Inches	Feet.	
De Wolf Street, extended to Copperthwaite Street . . . . .	4	337	
Edery Street, Broadway to Harvard Street . . . . .	6	678	
Eighth Street, Otis to Thorndike Street . . . . .	4	247	
Elm Street, extended north of Hampshire Street . . . . .	4	625	
Ellsworth Avenue, extended to Cambridge Street . . . . .	3	99	
Fourth Street, Gore to Cambridge Street . . . . .	4	212	
Foster Street, Irving to Foster Court . . . . .	4	45	
Foster Court, south from Foster Street . . . . .	3	387	
Frost Street, from Forest Street . . . . .	4	294	
Follen Street, from Concord Avenue . . . . .	4	657	
Franklin Street, Pleasant to Putnam Street . . . . .	6	2,205	
Fifth Street, Charles to Cambridge Street . . . . .	6	1,262	
Garden Street, Bond to Shepard Street . . . . .	6	635	
Hamilton Street, Magazine to Pearl Street . . . . .	6	450	
Hamilton Street, east from Pearl Street . . . . .	4	817	
Hancock Street, north from Franklin Street . . . . .	4	40	
Harvard Street, from Brattle Street . . . . .	4	286	
Hampshire Street, Davis to Portland Street . . . . .	12	183	
Inman Street, Harvard to Main Street . . . . .	12	1,000	
Inman Street, from Broadway . . . . .	6	232	
Irving Street, Brattle to Foster Street . . . . .	4	549	
Kinnard Street, Western Avenue to 3-inch pipe . . . . .	4	216	
Lee Street, Harvard Street to 4-inch pipe . . . . .	4	420	
Lopez Street, Pearl to Brookline Street . . . . .	4	513	
Lake Street, Pearl to Magazine Street . . . . .	6	490	
Main Street, Inman to Pleasant Street . . . . .	16	125	
Mount Auburn, Holyoke to Dunster Street . . . . .	4	218	
Mount Vernon, from North Avenue . . . . .	4	580	
North Avenue, from Rice Street . . . . .	6	513	
Norton Street, from Avon Street . . . . .	4	268	
Otis Street, Seventh to Eighth Street . . . . .	4	155	
Otis Street, Court to Second Street . . . . .	4	350	
Pumping Main, to connect new Engine . . . . .	24	45	
Prince Street, Pleasant to Magazine Street . . . . .	4	564	
Putnam Street, extended south . . . . .	4	270	
Pleasant Street, Main to Walnut Street . . . . .	12	3,000	
Perry Street, from Pearl Street . . . . .	4	225	
Portland Street, from Hampshire Street . . . . .	12	318	
Rockwell Street, Pleasant to River Street . . . . .	4	491	
Reservoir, discharge pipe . . . . .	20	75	
Reservoir, overflow pipe . . . . .	20	60	
Reservoir, overflow to Stand-pipe into Reservoir . . . . .	6	85	

STREETS.	Size Length.	
	Inches.	Feet.
Reservoir, overflow to Stand-pipe . . . . .	12	23
State Street, west from Village Street . . . . .	3	207
Sydney Street, from Front Street . . . . .	4	576
Shepard Street, from Garden Street to 4-inch pipe . . . . .	6	784
Squire's Court, from Gore Street . . . . .	3	387
Suffolk Street, Columbia to Norfolk Street . . . . .	4	603
Soden Street, extended north . . . . .	3	75
Soden Street, Franklin Street to 8-inch pipe . . . . .	4	220
Spring Street, from Fifth Street to 3-inch pipe . . . . .	4	272
Temple Street, from Austin Street to 3-inch pipe . . . . .	4	125
Union Street, Market to Hampshire Street . . . . .	4	396
Vine Street, 12 to 4 inch pipe, Court Street . . . . .	4	50
Watson Street, from Pearl Street . . . . .	4	360
Webster Place, from Pleasant Street . . . . .	4	361
Webster Street, from Pleasant Street . . . . .	4	50
Winsor Street, Harvard to School Street . . . . .	4	819
Warren Street, from Gore Street . . . . .	4	313
Worcester Street, Norfolk Street to 3-inch pipe . . . . .	3	120
Washington Court, from Putnam Street . . . . .	3	405
Well-room to pond, supply for Engine . . . . .	36	312

The following gates, stop-cocks, and blow-off pipes have been set during the year: —

STREETS.	Number	Size
		Inches.
Discharge pipe east side of Reservoir . . . . .	1	24
Discharge pipe west side of Reservoir . . . . .	1	20
Inman and Main Streets . . . . .	1	12
Pleasant and Main Streets . . . . .	1	12
Pleasant and Cottage Streets . . . . .	1	12
Opposite Rolling Mill, Portland Street . . . . .	1	12
Linnæan Street . . . . .	1	10
Mason and Brattle Streets, old one removed . . . . .	1	10
Main and Inman Streets . . . . .	1	8
Main and Pleasant Streets . . . . .	1	8
Garden and Bond Streets . . . . .	1	6
Garden and Shepard Streets . . . . .	1	6
Magazine and Hamilton Streets . . . . .	1	6
Pleasant Street and Harrison Avenue . . . . .	1	6
Pleasant and Cottage Streets . . . . .	1	6

STREETS.	NUMBER.	SIZE.
		Inches.
Pleasant and Franklin Streets . . . . .	2	6
Pleasant and Walnut Streets . . . . .	1	6
Magazine and Lake Streets . . . . .	1	6
Magazine and Cottage Streets . . . . .	1	6
Pearl and Cottage Streets . . . . .	1	6
Charles and Court Streets, 4-inch one removed . . . . .	1	6
Charles and Fifth Streets . . . . .	1	6
Cambridge and Fifth Streets . . . . .	1	6
Hampshire and Davis Streets . . . . .	1	6
Hampshire and Portland Streets . . . . .	1	6
Broadway and Ellery Street, 4-inch one removed . . . . .	1	6
Harvard and Ellery Streets . . . . .	1	6
Harvard and Dana Streets . . . . .	1	6
Broadway and Inman Street, 4-inch one removed . . . . .	1	6
Waste at west side of Reservoir . . . . .	1	6
Magazine and Auburn Streets . . . . .	1	4
Milk Street, at Bleachery . . . . .	1	4
North Avenue and Mellen Street . . . . .	1	4
Magazine and Brooks Streets . . . . .	1	4
Cambridge and Fourth Streets . . . . .	1	4
Harvard and Winsor Streets . . . . .	1	4
Main and Winsor Streets . . . . .	1	4
Essex and Harvard Streets . . . . .	1	4
Hampshire and Elm Streets . . . . .	1	4
North Avenue and Day Street . . . . .	1	4
Rockwell and Pleasant Streets . . . . .	1	4
Rockwell and River Streets . . . . .	1	4
Otis and Seventh Streets . . . . .	1	4
Otis and Third Streets . . . . .	1	4
Columbia and Harvard Streets . . . . .	1	4
Lee and Harvard Streets . . . . .	1	4
Hydrant Branch, Harvard and Main Streets . . . . .	1	4
Hydrant Branch, Trowbridge and Main Streets . . . . .	1	4
Brattle and Irving Streets . . . . .	1	4
Appian Way and Garden Street . . . . .	1	4
Lopez and Pearl Streets . . . . .	1	4
Williams and Pearl Streets . . . . .	1	4
Inman and Austin Streets . . . . .	2	4
Main Street, hydrant branch opposite City Hall . . . . .	1	4
Pleasant and Somerset Streets . . . . .	2	4
Pleasant and Prince Streets . . . . .	1	4
Pleasant and Short Streets . . . . .	2	4



STREETS.	NUMBER	SIZE.
		Inches.
Pleasant and Park Streets . . . . .	1	4
Pleasant and Warland Streets . . . . .	1	4
Pleasant and Webster Streets . . . . .	1	4
Pleasant and Webster Court . . . . .	1	4
Pleasant and Auburn Streets . . . . .	2	4
Pleasant and Green Streets . . . . .	2	4
Lake and Pearl Streets . . . . .	1	4
Erie and Pearl Streets . . . . .	1	4
Franklin and Pearl Streets . . . . .	1	4
Franklin and Soden Streets . . . . .	1	4
Franklin and Hancock Streets . . . . .	1	4
Franklin and Bay Streets . . . . .	1	4
Main Street, old one removed on bridge . . . . .	1	4
Franklin Street, hydrant branch . . . . .	1	4
Charles and Fourth Streets . . . . .	1	4
Fifth and Vine Streets . . . . .	2	4
Fifth and Spring Streets . . . . .	2	4
Fifth and Thorndike Streets . . . . .	2	4
Fifth and Otis Streets . . . . .	2	4
Sixth and Thorndike Streets . . . . .	1	4
Brattle and Hilliard Streets . . . . .	1	4
River and Kinnaird Streets . . . . .	1	4
River and Auburn Streets . . . . .	1	4
North Avenue and Mount Vernon Street . . . . .	1	4
Spring and Sixth Streets . . . . .	1	3
Williams and River Streets . . . . .	1	3
Washington and Winsor Streets . . . . .	1	3
Squire's Court and Gore Street . . . . .	1	3
Ellsworth Avenue and Cambridge Street . . . . .	1	2
Appian Way and Brattle Street . . . . .	1	2
Norton Street . . . . .	1	1½
Perry Street . . . . .	1	1½
Sydney Street . . . . .	1	1½
North Avenue . . . . .	1	1½
Webster Court . . . . .	1	1½
Hamilton Street . . . . .	1	1½
Squire's Court . . . . .	2	1½
Frost Street . . . . .	1	1½
State Street . . . . .	1	1½
Union Street . . . . .	1	1½
Mount Vernon Street . . . . .	1	1½

## RECAPITULATION.

312 feet	.	.	.	.	.	.	.	36-inch iron pipe.
45 feet	.	.	.	.	.	.	.	24-inch iron pipe.
135 feet	.	.	.	.	.	.	.	20-inch iron pipe.
125 feet	.	.	.	.	.	.	.	16-inch iron pipe.
4,716 feet	.	.	.	.	.	.	.	12-inch iron pipe.
9,572 feet	.	.	.	.	.	.	.	6-inch iron pipe.
16,186 feet	.	.	.	.	.	.	.	4-inch iron pipe.
2,324 feet	.	.	.	.	.	.	.	3-inch iron pipe.

## Gates.

1	.	.	.	.	.	.	.	24-inch.
1	.	.	.	.	.	.	.	20-inch.
4	.	.	.	.	.	.	.	12-inch.
2	.	.	.	.	.	.	.	10-inch.
2	.	.	.	.	.	.	.	8-inch.
21	.	.	.	.	.	.	.	6-inch.
60	.	.	.	.	.	.	.	4-inch.
4	.	.	.	.	.	.	.	3-inch.

## Stop-Cocks.

2	.	.	.	.	.	.	.	2-inch.
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## Blow-off Pipes.

12	.	.	.	.	.	.	.	1½-inch.
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There have been 507 supply-pipes put in during the year, making the number now in, 3,117.

The expense for care and repairs for the past year has been unusually large in consequence of the very cold weather during the past winter, the frost in some places penetrating six and a half feet deep, freezing many of the supplies, and several of the dead ends of main pipes, where there was no circulation of water. There were three sets of men employed for four months, most of the time in thawing out frozen pipes.

The main pipes have been lowered in River and Kinnaird Streets, and 47 supplies connected with them, and other pipes which froze up last winter have been lowered during the season.

Number of leaks in supply-pipes, 16.

Number of leaks in main pipes (iron) 123, 102 of which were at the joints of 3, 4, and 6-inch pipes, 6 from defect in pipes, 1



from a 12 inch and 3 from 20-inch pipes broken, and 3 at joints of 10-inch pipes where leaks were caused by settlement.

8 leaks in cement-pipes, 4 of them from driving-cocks rusting at the connection with iron, requiring new iron pipes to be put in — 4 of them from leaks through main pipe caused by settlement, and one from the blow of a pick, where parties were excavating for drain.

3 leaks in log, and thirty feet of log were taken out, and a 3-inch iron pipe laid with quarter bends, to give the town of Somerville room for a sewer which came directly against the log.

Water was blown off from iron pipes 30 times, and from lead pipe twice.

There have been 20 new hydrants set during the year, and 5 new ones to replace old ones taken out.

There have been 15 new meters set during the year, 3 of them in place of old ones taken out and of little or no value, except for old metal, making 27 meters now set; and in all cases where a large quantity of water is used the rates have increased, in some places very largely, although the parties had complained of the amount of their bills before meters were set on their premises.

Average number of gallons pumped daily the past year . . . . .	1,732,755
Average number of gallons pumped to Reservoir and Stand-pipe for each hundred pounds of coal burned	56,020
Average daily increase over last year . . . . .	471,295

## STATEMENT

OF STOCK ON HAND PERTAINING TO CONSTRUCTION,  
EXCLUSIVE OF TOOLS.

1	.	.	.	.	.	.	36-inch cast-iron pipe.
2	.	.	.	.	.	.	24-inch cast-iron pipes.
4	.	.	.	.	.	.	20-inch cast-iron pipes.
2	.	.	.	.	.	.	16-inch cast-iron pipes.
9	.	.	.	.	.	.	12-inch cast-iron pipes.
1	.	.	.	.	.	.	10-inch cast-iron pipe.
3	.	.	.	.	.	.	8-inch cast-iron pipes.
295	.	.	.	.	.	.	6-inch cast-iron pipes.
145	.	.	.	.	.	.	4-inch cast-iron pipes.
1	.	.	.	.	.	.	24-inch cast-iron Y.
2	.	.	.	.	.	.	24-inch cast-iron $\frac{1}{4}$ bends.
1	.	.	.	.	.	.	6-inch cast-iron $\frac{1}{4}$ bend.
10	.	.	.	.	.	.	10-inch cast-iron $\frac{1}{8}$ bends.
5	.	.	.	.	.	.	6-inch cast-iron $\frac{1}{8}$ bends.
4	.	.	.	.	.	.	4-inch cast-iron $\frac{1}{8}$ bends.
1	.	.	.	.	.	.	24 $\times$ 20 inch cast-iron T.
1	.	.	.	.	.	.	24 $\times$ 16-inch cast-iron T.
1	.	.	.	.	.	.	24 $\times$ 6-inch cast-iron T.
4	.	.	.	.	.	.	20 $\times$ 6-inch cast-iron T's.
3	.	.	.	.	.	.	12 $\times$ 6-inch cast-iron T's.
8	.	.	.	.	.	.	12 $\times$ 4-inch cast-iron T's.
1	.	.	.	.	.	.	10 $\times$ 6-inch cast-iron T.
14	.	.	.	.	.	.	6 $\times$ 6-inch cast-iron T's.
11	.	.	.	.	.	.	6 $\times$ 4-inch cast-iron T's.
25	.	.	.	.	.	.	4-inch cast-iron T's.
6	.	.	.	.	.	.	3-inch cast-iron T's.
1	.	.	.	.	.	.	20 $\times$ 6-inch cast-iron cross.
1	.	.	.	.	.	.	12 $\times$ 6-inch cast-iron cross.
17	.	.	.	.	.	.	6 $\times$ 6-inch cast-iron crosses.
13	.	.	.	.	.	.	6 $\times$ 4-inch cast-iron crosses.
25	.	.	.	.	.	.	4-inch cast-iron crosses.
2	.	.	.	.	.	.	3-inch cast-iron crosses.
2	.	.	.	.	.	.	24-inch cast-iron sleeves.
2	.	.	.	.	.	.	20-inch cast-iron sleeves.
1	.	.	.	.	.	.	16-inch cast-iron sleeve.

3	.	.	.	.	.	.	12-inch cast-iron sleeve
2	.	.	.	.	.	.	10-inch cast-iron sleeve
2	.	.	.	.	.	.	8-inch cast-iron sleeve
6	.	.	.	.	.	.	6-inch cast-iron sleeve
10	.	.	.	.	.	.	4-inch cast-iron sleeve
9	.	.	.	.	.	.	3-inch cast-iron sleeve
1	.	.	.	.	.	.	24 × 10-inch cast-iron r
4	.	.	.	.	.	.	12 × 6-inch cast-iron re
9	.	.	.	.	.	.	6 × 4-inch cast-iron re
7	.	.	.	.	.	.	4 × 3-inch cast-iron re
1	.	.	.	.	.	.	4-inch cast-iron set-of
4	.	.	.	.	.	.	hydrant frames and c
2	.	.	.	.	.	.	gate frames and cover
6	.	.	.	.	.	.	hydrant bends.
12	.	.	.	.	.	.	hydrant boxes, wood.
13	.	.	.	.	.	.	gate boxes, wood.
1	.	.	.	.	.	.	24-inch gate.
1	.	.	.	.	.	.	20-inch gate.
1	.	.	.	.	.	.	16-inch gate.
1	.	.	.	.	.	.	12-inch gate.
1	.	.	.	.	.	.	10-inch gate.
1	.	.	.	.	.	.	8-inch gate.
9	.	.	.	.	.	.	6-inch gates.
7	.	.	.	.	.	.	4-inch gates.
12	.	.	.	.	.	.	3-inch gates.

2,400 lbs. lead.  
200 lbs. hemp packing.

Respectfully submitted,  
WM. H. PRATT,  
*Superin.*

LIBRARY

City of Cambridge.

[ 5 ]

ANNUAL REPORT

OF

/-

THE WATER BOARD

TO

THE CITY COUNCIL,

FOR THE YEAR 1869.

WITH REPORT CONCERNING THE SINKING FUND.



CAMBRIDGE:

PRESS OF JOHN WILSON AND SON

1870.



City of Cambridge.

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ANNUAL REPORT  
OF  
THE WATER BOARD  
TO  
THE CITY COUNCIL,  
FOR THE YEAR 1869;

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CAMBRIDGE:  
PRESS OF JOHN WILSON AND SON.

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# REPORT

## OF THE

### CAMBRIDGE WATER BOARD.

As required by an ordinance of the City, the Cambridge Water Board herewith present to the City Council their fifth

#### ANNUAL REPORT,

Embracing a statement of the progress and present condition of the Works, together with an account of the receipts and expenditures, clearly demonstrating the fact that, without any increase of water-rates, the receipts hereafter will be sufficient to pay the expenses and interest, and pay into the Sinking Fund a sum sufficient to meet the requirements of the law.

The cost of the Works, April 28, 1865, was . .	\$291,480.00
Expended for extension of the Works for the year ending Nov. 30, 1866 . . . . .	88,185.74
Expended for extension of the Works for the year ending Nov. 30, 1867 . . . . .	188,625.06
Expended for extension of the Works for the year ending Nov. 30, 1868 . . . . .	160,496.38
Expended for extension of the Works for the year ending Nov. 30, 1869 . . . . .	99,313.51
Total cost of the Works, Nov. 30, 1869 .	<u>\$828,100.69</u>
Receipts from water-rates for the year ending Nov. 30, 1869 . . . . .	\$76,149.30
Receipts from water-rates for the year ending Nov. 30, 1868 . . . . .	63,747.42
Increase of water-rates . . . . .	<u>\$12,401.88</u>



Receipts from all sources for the year ending Nov.	
30, 1869 . . . . .	\$91,347.92
Receipts from all sources for the year ending Nov.	
30, 1868 . . . . .	79,434.56
Increase of receipts in 1869 . . . . .	\$11,913.36
Total Cash Receipts for the year ending Nov. 30,	
1869 . . . . .	\$91,347.92
Expended for care and repair account	\$20,082.91
Expended on supply account . . .	13,465.91
Interest . . . . .	46,344.00
	<hr/>
	79,892.82
Balance unexpended . . . . .	\$11,455.10

For a more detailed statement of the financial account of the Works, we would refer you to the accompanying Report of the Water Registrar.

The Sinking Fund established for the final liquidation of the Water Bonds amounted on the first day of July, 1869, to \$27,726.44.

Since the first of April last no Superintendent has been employed, but the work has been performed under the direction of different members of the Board.

A new coal shed has been built upon land proposed to be conveyed to the city by Jacob Hittinger, Esq. The rear wall around the engine-house has been relaid, and the old pumps have been connected with the new well-room.

The twelve-inch pipe, which formerly connected the pumps with the reservoir, has been taken up, and laid down in North Avenue and Everett Street, and it is intended to continue the twelve-inch pipe through Oxford Street from Everett to Sacramento Street, there to connect with the six-inch pipe in Sacramento Street as soon as the main drain shall be completed through Oxford Street, it not being deemed safe to lay it before.

In the progress of the work the present year we have laid of

12-inch pipe . . . . .	2,131 feet.
6-inch pipe . . . . .	14,972 "
4-inch pipe . . . . .	16,075 "
3-inch pipe . . . . .	1,229 "
1½-inch pipe . . . . .	130 "

Total amount of pipe laid, 34,577 feet, or about six and three-quarter miles.

It will be perceived that the Board have adopted the practice of using larger sized pipes than heretofore, believing it to be for the interest of the city.

The reservoir, of the permanency of which there was some apprehension at the time of presenting our last Annual Report, proves to be a very substantial structure, and we feel confident will give entire satisfaction.

The new pumps, which at the close of the last year had not been fully tested, have been in constant use, their weak points have been developed, and all necessary repairs made promptly by and at the expense of the Contractors, and we are confident that we now have the machinery in most perfect order, completed fully up to the terms of the contract.

The care and repair account is somewhat increased over that of former years, but, as an offset, this increase is more than compensated for in the excess of coal on hand over that of the previous year, there being on hand at the present time about five hundred and fifty tons against a few tons last year, which leaves the actual expense for care and repairs for the current year less than that of 1868.

Thirty-two new meters have been set in connection with the larger supplies, making the number now in use fifty-eight. Fifty-two fire hydrants have been set, making the whole number now in use one hundred and ninety-three. Four hundred and fifty-six new supply pipes have been put in, making the whole number three thousand five hundred and seventy-three.

The annexed Schedule gives a definite statement of the location of the pipe, and a full description of all branches of work done the present year.

STREETS.	SIZE.		LENGTH.
	Inches	Feet	
Amory Street, from Broadway . . . . .	6	547	
Antrim Street, from Broadway . . . . .	6	120	
Athens Street, from Mount Auburn Street . . . . .	4	167	
Auburn Court, from Auburn Street . . . . .	14	130	
Auburn Street, from terminus easterly to connect . . . . .	4	356	
Auburn Street, to connect with Pearl Street . . . . .	4	111	
Bedford Street, from Porter Street . . . . .	4	222	
Bigelow Street, from Harvard Street . . . . .	6	216	
Bigelow Street, from Main Street . . . . .	6	262	
Bixby Place, from Front Street . . . . .	3	158	
Bow Street, from Main Street . . . . .	4	321	
Bowdoin Street, extended . . . . .	4	306	
Brookline Street, from Walnut to Erie Street . . . . .	6	836	
Brookline Street, from Auburn Street south to connect . . . . .	4	166	
Charles River Street, extended . . . . .	4	327	
Columbia Street, from Broadway to Cambridge Street . . . . .	6	2010	
Copperthwaite Street, extended . . . . .	4	292	
Dyke Street, from Charles River Street . . . . .	4	143	
East Street, from Bridge Street . . . . .	6	251	
Eliot Street, from Brighton Street . . . . .	4	428	
Ellery Street, from Broadway northerly . . . . .	6	451	
Ellery Street, from Main to Harvard Street . . . . .	6	648	
Elm Street, northerly to connect . . . . .	4	284	
Essex Street, from terminus to connect with Main Street . . . . .	4	120	
Everett Street, from Oxford Street to North Avenue, through North Avenue to Holmes Place . . . . .	12	2181	
Follen Street, extended . . . . .	4	178	
Fourth and Vine Streets, to connect with Vine Street . . . . .	4	175	
Franklin Street, from Sidney Street . . . . .	4	367	
Front Street, southerly for Blow-off . . . . .	3	86	
Gilpin Street, from Washington to School Street . . . . .	6	258	
Gore and Bridge Streets, from Fourth Street to Prison Point . . . . .	6	2505	
Green Street, from Sidney to Brookline Street . . . . .	4	622	
Green Street, from terminus across Bay Street . . . . .	4	463	
Green Street, from terminus toward Magazine Street . . . . .	4	105	
Hampshire Street, from Columbia to Winsor Street . . . . .	6	550	
Hampshire Street, from Columbia Street westerly to connect . . . . .	4	71	
Harvard Street, from Columbia to Cherry Street to complete line . . . . .	4	426	
Hillhard Street, from Brattle Street . . . . .	4	351	
Holyoke Street, to connect with Harvard Street . . . . .	4	106	
Holyoke Place, to connect with Mount Auburn Street . . . . .	3	215	
Howard Street, from Western Avenue to River Street . . . . .	4	515	
Inman Street, extended northerly . . . . .	6	180	
Jay Street, from Western Avenue northerly . . . . .	4	256	
Jefferson Street, from Warren Street . . . . .	4	345	
Lambert Street, from Cambridge to Gore Street . . . . .	6	399	

# WATER WORKS.

7

STREETS	SIZE.		LENGTH.
	Inches	Feet	
Magazine Street, from Webster to Auburn Street . . . . .	6	800	
Magazine Street, from Erie to Walnut Street . . . . .	6	871	
Market Street, from Columbia to Elm Street . . . . .	4	180	
Marsh Court, extended . . . . .	3	27	
Moore Street, Broadway to Washington Street . . . . .	6	760	
Mount Auburn Street, from Brighton Street westerly . . . . .	4	210	
Mount Auburn Street, from Putnam Street westerly to connect . . . . .	4	219	
Marlock Street, from Hampshire Street . . . . .	4	244	
Norfolk Street, from Broadway to Harvard Street . . . . .	6	418	
Oak Street, from Cambridge to Houghton Street . . . . .	6	456	
Oak Street, from Houghton north to connect . . . . .	4	812	
Orchard Street, from Russell Street . . . . .	4	319	
Oxford Street, from Forest Street northerly . . . . .	4	265	
Oxford Street, from Harris Street southerly . . . . .	4	257	
Park Street, to connect with Pleasant . . . . .	4	170	
Pearl Street, from Allston to Walnut Street . . . . .	4	334	
Petungill Court, from Second Street . . . . .	3	116	
Porter Street, from Warren Street . . . . .	4	392	
Raymond Street, from Linnæan Street . . . . .	6	1140	
Roseland Street, from Frost Street . . . . .	4	736	
School Street, to connect with Cherry Street . . . . .	4	103	
School Street, from terminus to connect with Main Street . . . . .	4	152	
School Court, extended . . . . .	3	189	
Second and Spring Streets, from terminus to Third Street . . . . .	4	504	
Sixth Street, from Cambridge to Gore Street . . . . .	4	260	
Sixth Street, from Spring to Charles Street . . . . .	4	489	
Spring Street, from Eighth Street westerly . . . . .	3	45	
Spring Street, to connect with Fourth Street . . . . .	4	66	
State Street, from Front to Village Street . . . . .	4	183	
Tenney Court, from Orchard Street . . . . .	3	392	
Thornlike Street, to connect dead ends between Fourth and Fifth Streets . . . . .	4	100	
Tremont Street, from Cambridge to Webster Avenue . . . . .	4	1068	
Trowbridge Street, from terminus to Main Street . . . . .	4	153	
Union Street, from Hampshire Street northerly to connect . . . . .	4	119	
Valentine Street, from Pearl Street easterly to connect . . . . .	4	283	
Walnut Court, from Magazine Court northerly . . . . .	3	88	
Walnut Street, from Magazine to Brookline Street . . . . .	6	1136	
Warren Street, southerly from terminus to connect with Cambridge Street . . . . .	4	342	
Washington Street, from Moore to Gilpin Street . . . . .	6	58	
Wendell Street, from Oxford Street to connect . . . . .	4	467	
Wallow Place, from Cambridge Street . . . . .	4	492	
Winthrop Street, from Brighton Street easterly . . . . .	4	176	
Winthrop Street, extended from terminus westerly . . . . .	3	48	



The following gates and blow-off pipes have been set during the year : —

STREETS	NUMBER	Size Inches
Bigelow and Harvard Streets . . . . .	1	6
Bow Street at Reservoir . . . . .	1	4
Brattle and Hiland Streets . . . . .	1	4
Bridge and East Streets . . . . .	1	6
Brighton and Elliot Streets . . . . .	1	4
Broadway and Amory Street, in place of 4-inch removed . . .	1	6
Broadway and Antrim Street . . . . .	1	6
Broadway and Columbia Street . . . . .	1	6
Broadway and Ellery Street, in place of 4-inch removed . . .	1	6
Broadway and Moore Street . . . . .	1	6
Broadway and Norfolk Street . . . . .	1	6
Brookline and Auburn Streets . . . . .	1	4
Brookline and Green Streets . . . . .	1	4
Brookline and Walnut Streets . . . . .	1	6
Cambridge and Columbia Streets . . . . .	1	6
Cambridge, near Dana Street . . . . .	1	10
Cambridge and Lambert Streets . . . . .	1	6
Cambridge and Oak Streets . . . . .	1	6
Cambridge and Sixth Streets . . . . .	1	4
Cambridge and Tremont Streets . . . . .	1	4
Cambridge and Warren Streets . . . . .	1	4
Cambridge Street and Willow Place . . . . .	1	4
Columbia and Market Streets . . . . .	1	4
Fourth and Spring Streets . . . . .	1	4
Fourth and Vine Streets . . . . .	2	4
Frost and Forest Streets . . . . .	1	4
Gore and Second Streets . . . . .	1	6
Gore and Warren Streets . . . . .	1	4
Hampshire and Columbia Streets . . . . .	1	6
Hampshire and Columbia Streets . . . . .	1	4
Hampshire and Elm Streets . . . . .	1	4
Hampshire and Union Streets . . . . .	1	4
Hampshire and Winsor Streets . . . . .	1	6
Harvard and Cherry Streets . . . . .	1	4
Harvard and Columbia Streets . . . . .	1	4
Harvard and Holyoke Streets . . . . .	1	4
Harvard and Moore Streets . . . . .	1	4
Harvard and Norfolk Streets . . . . .	1	6
Hydrant Branch, Bridge and Short Streets . . . . .	1	4
Hydrant Branch, Everett Street . . . . .	1	4
Hydrant Branch, Everett and Oxford Streets . . . . .	1	4
Hydrant Branch, North and East Streets . . . . .	1	4

# WATER WORKS.

9

STREETS.	NUMBER.	SIZE.
		Inches.
Hydrant Branch, North Avenue and Jarvis Street . . . . .	1	4
Hydrant Branch, West Boston Bridge . . . . .	1	4
Linnæan and Raymond Streets . . . . .	1	6
Magazine Court and Magazine Street . . . . .	1	8
Magazine and Auburn Streets . . . . .	1	6
Magazine and Cottage Streets . . . . .	1	6
Magazine and Short Streets . . . . .	1	6
Magazine and Walnut Streets . . . . .	1	6
Main and Bigelow Streets . . . . .	1	6
Main and Bow Streets . . . . .	1	4
Main and Cherry Streets, in place of old one removed . . . . .	1	4
Main and Ellery Streets, in place of 4-inch removed . . . . .	1	6
Main and Essex Streets . . . . .	1	6
Main and School Streets . . . . .	1	4
Moore and Hastings Streets . . . . .	1	4
Mount Auburn Street and Holyoke Place . . . . .	1	8
North Avenue and Holmes Place . . . . .	1	12
North Avenue and Roseland Street . . . . .	1	4
North Avenue and Wendell Street, in place of old one removed . . . . .	1	4
Orchard Street and Tenney Court . . . . .	1	4
Oxford and Everett Streets . . . . .	1	12
Oxford and Harris Streets . . . . .	1	4
Pearl and Valentine Streets . . . . .	1	4
Pearl and Walnut Streets . . . . .	1	4
Putnam and Mount Auburn Streets . . . . .	1	4
River and Howard Streets . . . . .	1	4
School and Cherry Streets . . . . .	1	4
School and Gilpin Streets . . . . .	1	4
Second and Cambridge Streets . . . . .	1	4
Sixth and Spring Streets . . . . .	1	4
Third and Spring Streets . . . . .	2	4
Warren and Porter Streets . . . . .	1	4
Washington and Moore Streets . . . . .	1	6

# BLOW-OFF PIPES.

STREETS.	NUMBER.	SIZE.
		Inches.
Bedford Street . . . . .	1	1½
Bixby Place . . . . .	1	1½
Charles River Street . . . . .	1	1½
Dyke Street . . . . .	1	1½
Eliot Street . . . . .	1	1½
Franklin Street . . . . .	1	1½

STREETS.	NUMBER.	SIZE.
		Inches.
Front Street . . . . .	1	1½
Green Street . . . . .	1	1½
Green and Bay Streets . . . . .	1	1½
Jay Street . . . . .	1	1½
Jefferson Street . . . . .	1	1½
Mount Auburn Street . . . . .	1	1½
Murdock Street . . . . .	1	1½
Oxford Street . . . . .	2	1½
Porter Street . . . . .	1	1½
Raymond Street . . . . .	1	1½
School Court . . . . .	1	1½
Sixth Street . . . . .	1	1½
Tenney Court . . . . .	1	1½
Wendell Street . . . . .	1	1½
Willow Place . . . . .	1	1½
Winthrop Street . . . . .	1	1½

RECAPITULATION.

2,181 feet . . . . .	12-inch iron pipe.
14,972 feet . . . . .	6-inch iron pipe.
16,075 feet . . . . .	4-inch iron pipe.
1,269 feet . . . . .	3-inch iron pipe.
180 feet . . . . .	1½-inch iron pipe.

GATES.

2 . . . . .	12-inch.
1 . . . . .	10-inch.
25 . . . . .	6-inch.
47 . . . . .	4-inch.
2 . . . . .	3-inch.

BLOW-OFF PIPES.

23 . . . . .	1½-inch.
--------------	----------

Statement of total number of feet of main and branch pipes, gates, stop-cocks, &c., laid to Dec. 1, 1869 : —

812 feet . . . . .	36-inch iron pipe.
6,155 feet . . . . .	24-inch iron pipe.
18,282 <sup>6</sup> / <sub>13</sub> feet . . . . .	20-inch iron pipe.

## WATER WORKS.

11

[illegible]

## WATER-GATES.

[illegible]

## STOP-COCKS.

[illegible]

## WASTE-GATES.

[illegible]

## BLOW-OFF PIPES.

**185 . . . . . 1½-inch.**

Total number of feet of pipe laid,  $280,373\frac{1}{2}$ , or about  $53\frac{3}{4}$  miles.

**Number of leaks in supply pipes, 23.**

Number of leaks in main pipes, 133, 103 of which were at the joints, 6 caused by driving-cocks coming out of main pipes, 4 from defective pipes, 4 caused by settlement, 6 leaks in cement pipes, 7 leaks in aqueduct logs, and 3 leaks in blow-off pipes.



Water was blown off main pipes 27 times.

Nine fire hydrants and thirty-five gates have been raised to conform to the change of grade in the streets.

Twenty-eight Burnettized hydrant boxes, and three gate boxes have been put in, in place of old ones decayed.

Whole number of gallons pumped the last year . . . . .	588,763,182
Daily average . . . . .	1,617,481
Average number of gallons pumped to Reservoir and Stand-pipe for each hundred pounds of coal burned . . . . .	73,877
Average daily decrease . . . . .	115,274
Amount of coal used during the year	398 tons, 9 cwt., 50 lbs.

To perform this work the services of the pumps are required only eight hours in twenty-four. For five hours the water is delivered into the reservoir at a height of about seventy-three feet, and for three hours it is delivered through the stand pipe at a height of about ninety feet. Although the pumps are registered at a capacity of five million gallons per day, yet the raising that amount of water evidently does not exhaust their capacity, which is the best evidence to be obtained of the perfection and ability of the machinery furnished by Mr. Worthington, under his contract, and of the efficient manner in which the Works have been conducted by our present Engineer, Mr. Thomas G. Bruce.

## STATEMENT

OF STOCK ON HAND PERTAINING TO CONSTRUCTION, EXCLUSIVE OF TOOLS

1 . . . . .	36-inch cast-iron pipe.
2 . . . . .	24-inch cast-iron pipes.
4 . . . . .	20-inch cast-iron pipes.
8 . . . . .	16-inch cast-iron pipes.
10 . . . . .	12-inch cast-iron pipes.
3 . . . . .	8-inch cast-iron pipes.
617 . . . . .	6-inch cast-iron pipes.
594 . . . . .	4-inch cast-iron pipes.
86 . . . . .	3-inch cast-iron pipes.

2	.	.	.	.	.	.	.	6-inch cast-iron off-set pipes.
5	.	.	.	.	.	.	.	4-inch cast-iron off-set pipes.
1	.	.	.	.	.	.	.	24-inch cast-iron Y.
2	.	.	.	.	.	.	.	24-inch cast-iron $\frac{1}{4}$ bends.
3	.	.	.	.	.	.	.	12-inch cast-iron $\frac{1}{4}$ bends.
6	.	.	.	.	.	.	.	6-inch cast-iron $\frac{1}{4}$ bends.
7	.	.	.	.	.	.	.	4-inch cast-iron $\frac{1}{4}$ bends.
9	.	.	.	.	.	.	.	10-inch cast-iron $\frac{1}{8}$ bends.
1	.	.	.	.	.	.	.	8-inch cast-iron $\frac{1}{8}$ bends.
6	.	.	.	.	.	.	.	4-inch cast-iron $\frac{1}{8}$ bends.
1	.	.	.	.	.	.	.	24 × 20-inch cast-iron T.
1	.	.	.	.	.	.	.	24 × 16-inch cast-iron T.
1	.	.	.	.	.	.	.	24 × 6-inch cast-iron T.
4	.	.	.	.	.	.	.	20 × 6-inch cast-iron T's.
2	.	.	.	.	.	.	.	12 × 6-inch cast-iron T's.
5	.	.	.	.	.	.	.	12 × 4-inch cast-iron T's.
3	.	.	.	.	.	.	.	10 × 6-inch cast-iron T's.
1	.	.	.	.	.	.	.	8 × 4-inch cast-iron T.
23	.	.	.	.	.	.	.	6 × 4-inch cast-iron T's.
2	.	.	.	.	.	.	.	12-inch cast-iron T's.
24	.	.	.	.	.	.	.	6-inch cast-iron T's.
1	.	.	.	.	.	.	.	4-inch cast-iron T.
1	.	.	.	.	.	.	.	3-inch cast-iron T.
1	.	.	.	.	.	.	.	20 × 12-inch cast-iron cross.
1	.	.	.	.	.	.	.	20 × 6-inch cast-iron cross.
6	.	.	.	.	.	.	.	12 × 6-inch cast-iron crosses.
5	.	.	.	.	.	.	.	12 × 4-inch cast-iron crosses.
29	.	.	.	.	.	.	.	6 × 4-inch cast-iron crosses.
25	.	.	.	.	.	.	.	6-inch cast-iron crosses.
48	.	.	.	.	.	.	.	4-inch cast-iron crosses.
2	.	.	.	.	.	.	.	3-inch cast-iron crosses.
2	.	.	.	.	.	.	.	24-inch cast-iron half sleeves.
1	.	.	.	.	.	.	.	20-inch cast-iron half sleeve.
1	.	.	.	.	.	.	.	16-inch cast-iron sleeve.
1	.	.	.	.	.	.	.	12-inch cast-iron sleeve.
7	.	.	.	.	.	.	.	12-inch cast-iron half sleeves.
3	.	.	.	.	.	.	.	10-inch cast-iron half sleeves.
1	.	.	.	.	.	.	.	10-inch cast-iron sleeve.

## WATER WORKS.

2	.	.	.	.	.	.	.	.	8-inch cast-iron sleeves.
3	.	.	.	.	.	.	.	.	8-inch cast-iron half sleeve
1	.	.	.	.	.	.	.	.	6-inch cast-iron half sleeve
11	.	.	.	.	.	.	.	.	6-inch cast-iron sleeves.
7	.	.	.	.	.	.	.	.	4-inch cast-iron sleeves.
1	.	.	.	.	.	.	.	.	4-inch cast-iron half sleeve
7	.	.	.	.	.	.	.	.	3-inch cast-iron sleeves.
1	.	.	.	.	.	.	.	.	24 × 12-inch cast-iron red
11	.	.	.	.	.	.	.	.	12 × 6-inch cast-iron red
3	.	.	.	.	.	.	.	.	10 × 6-inch cast-iron red
3	.	.	.	.	.	.	.	.	8 × 6-inch cast-iron red
21	.	.	.	.	.	.	.	.	6 × 4-inch cast-iron red
7	.	.	.	.	.	.	.	.	hydrant frames and covers.
20	.	.	.	.	.	.	.	.	gate frames and covers.
5	.	.	.	.	.	.	.	.	hydrant bends.
3	.	.	.	.	.	.	.	.	3-inch fire hydrants.
5	.	.	.	.	.	.	.	.	Burnettized hydrant boxes.
47	.	.	.	.	.	.	.	.	Burnettized gate boxes.
4	.	.	.	.	.	.	.	.	Burnettized meter boxes.
1	.	.	.	.	.	.	.	.	24-inch gate.
1	.	.	.	.	.	.	.	.	20-inch gate.
1	.	.	.	.	.	.	.	.	16-inch gate.
1	.	.	.	.	.	.	.	.	12-inch gate.
1	.	.	.	.	.	.	.	.	10-inch gate.
1	.	.	.	.	.	.	.	.	8-inch gate.
22	.	.	.	.	.	.	.	.	6-inch gates.
9	.	.	.	.	.	.	.	.	4-inch gates.
7	.	.	.	.	.	.	.	.	3-inch gates.
3	.	.	.	.	.	.	.	.	1½-inch blow-offs.

972 lbs. lead.

333 lbs. hemp packing.

All which is respectfully submitted.

JOHN SARGENT,	} <i>Can</i>
CHAS. H. SAUNDERS,	
ROBERT DOUGLASS,	
A. K. P. WELCH,	
SAMUEL SLOCOMB,	
HENRY W. MUZZEY,	
C. W. KINGSLEY,	<i>Water</i>

# REPORT

OF

## THE WATER REGISTRAR.

WATER REGISTRAR'S OFFICE, }  
CAMBRIDGE, Dec. 1, 1869. }

*To the Cambridge Water Board. —*

GENTLEMEN, — In compliance with the provisions of the ordinance for the care and management of the Cambridge Water Works, the undersigned respectfully submits the following Report of receipts and expenditures for the year ending Nov. 30, 1869.

### Receipts.

Water-rates . . . . .	\$76,149.30
Supply account for pipe, laying, repairing, &c. . . . .	14,150.23
Cash received from Engineer for rent of house . . . . .	300.00
Cash received for pasturage on land in Somerville . . . . .	16.00
Cash received from City of Cambridge for old stone . . . . .	250.00
Cash received from sales of old iron . . . . .	482.39
<b>Total cash receipts from all sources . . . . .</b>	<b>\$91,347.92</b>
All of which has been paid into the City Treasury.	

### Expenditures.

The expenditures for the care and management of the Works for the year ending Nov. 30, 1869, have been as follows: —

For care and repairs . . . . .	\$7,492.30
For pumping service . . . . .	9,732.29
For office expenses . . . . .	2,857.32
<b>Total amount . . . . .</b>	<b>\$20,082.91</b>
The expenditure on the extension of the Works for	
the year ending Nov. 30, 1869, was . . . . .	\$99,313.51

WATER WORKS.

The expenditure on supply account for the year end-	
ing Nov. 30, 1869, was . . . . .	\$13,465.9
Received for water-rates for the year ending Nov. 30,	
1869 . . . . .	76,149.3
Expended for the care and management of the Works	20,081.9
Balance in favor of the Works . . . . .	
	\$56,067.39

Supply Account.

Cash received on above account . . . .	\$14,150.23
Now due .. . . .	6,878.13
	\$21,028.36
There was reported as due Dec. 1, 1868 .	\$5,314.55
Since expended . . . . .	13,465.91
	18,780.46
Balance in favor of account . . . . .	
	\$2,247.90

During the year the water has been turned off for non-payment of rates thirty-seven times. Of this number twenty-seven have been let on, leaving a balance of ten still remaining off.

STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, &c., SUPPLIED WITH FRESH POND WATER TO DEC. 1, 1869.

- 4863 Families.
- 402 Stables.
- 272 Hand Hose.
- 193 Fire Hydrants.
- 148 Stores.
- 58 Stationary Engines.
- 34 Boarding-houses.
- 29 Reservoirs.
- 19 Saloons, and Victualling Houses.
- 19 School-houses.
- 16 Soap Works.
- 15 Bakeries.
- 13 Barber Shops.

- 13 Fish Markets.
- 13 Meat Markets.
- 11 Blacksmith Shops.
- 10 Furniture Manufactories.
- 9 Green-houses.
- 9 Machine Shops.
- 8 Churches.
- 8 Printing Offices.
- 8 Tallow Manufactories.
- 7 Livery Stables.
- 6 Photograph Rooms.
- 5 Banks.
- 5 Billiard Rooms.
- 5 Public Halls.
- 5 Public Houses.
- 4 Book-binderies.
- 4 Fire-engine Houses.
- 4 Fountains.
- 4 Planing Mills.
- 4 Police Stations.
- 4 Horse-railway Stables.
- 4 Post-offices.
- 4 Stone Yards.
- 3 Brush Manufactories.
- 3 Club Rooms.
- 3 Harness Shops.
- 3 Iron Foundries.
- 3 Laboratories.
- 3 Slaughter Houses.
- 2 Bacon Works.
- 2 Box Manufactories.
- 2 Carriage Manufactories.
- 2 Cattle Yards.
- 2 Chemical Works.
- 2 Club Stables.
- 2 Cooper Shops.
- 2 Cotton-waste Manufactories.
- 2 Cow Pastures.

- 2 Depots.
- 2 Libraries.
- 2 Nurseries.
- 2 Oil Manufactories.
- 2 Tin-ware Manufactories.
- 1 Beer Manufactory.
- 1 Bleachery.
- 1 Boiler Manufactory.
- 1 Bone Manufactory.
- 1 Brass Foundry.
- 1 Brewery.
- 1 Brick Yard.
- 1 Cigar Manufactory.
- 1 City Hall.
- 1 Currier Shop.
- 1 Distillery.
- 1 Gas Works.
- 1 Gymnasium.
- 1 Lard Works.
- 1 Laundry.
- 1 Lead-pipe Works.
- 1 Looking-glass Manufactory.
- 1 Marble Works.
- 1 Masonic Hall.
- 1 Organ Manufactory.
- 1 Piano Manufactory.
- 1 Reversible Paper Collar Co.
- 1 Rolling Mill.
- 1 Sausage Manufactory.
- 1 Steam Railroad.
- 1 Stereotype Foundry.
- 1 Sugar Refinery.
- 1 Tube Works.
- 1 University.
- 1 Vinegar Manufactory.

During the year thirty-two meters have been applied to the premises of water-takers, making the total number now in use fifty-eight ; they are attached to a variety of establishments as follows : —

	SIZE OF METERS.						
	$\frac{1}{4}$ inch.	$\frac{1}{2}$ inch.	1 inch.	1 $\frac{1}{2}$ inch.	2 inch.	3 inch.	4 inch.
Middlesex Bleachery . . . . .							1
North, Meriam, & Co. . . . .					1		
Boston and Lowell Railroad Co. . . . .			1		3		
Leon Goodall & Co. . . . .					1		
J. P. Squire & Co. . . . .					1		
Beal & Hooper . . . . .					1		
New England Glass Co. . . . .					1		
American Tube Works . . . . .					1		
Billings & Bullock . . . . .			1				
Welch, Bigelow, & Co. . . . .		1					
Commons Hall . . . . .	1						
Shawmut Iron Works . . . . .	1						
Bowman, Grant, & Co. . . . .			1				
H. O. Houghton & Co. . . . .			1				
Cambridge Laundry . . . . .			1				
Broadway Glass Works . . . . .				1	1		
Doe & Charmois . . . . .				1			
House of Correction . . . . .					1		
Union Glass Works . . . . .			2				
Boston Chemical Works . . . . .					1		
C. L. Jones & Co. . . . .			1				
Boston Rolling Mill . . . . .					1		
Metallic Compression Casting Co. . . . .			1				
Miller Crabbie . . . . .			1				
S. M. Cofran . . . . .					1		
Edmund Smith . . . . .			1				
John Wilson & Son . . . . .			1				
Reversible Collar Co. . . . .			1				
B. P. Clark . . . . .			1				
John Reardon & Sons . . . . .			1				
Boston Stamping Co. . . . .			1				
Brewery . . . . .			1				
Woodbury & Co. . . . .					1		
Braman, Shaw, & Co. . . . .				1			
S. C. Calef . . . . .				1			
A. F. Lemon & Co. . . . .			1				
Cambridge Gas Light Co. . . . .						1	
L. Kinsley & Co. . . . .					1		
George G. Page & Co. . . . .			1				
W. E. & B. Simpson . . . . .			1				
Curtis Davis . . . . .				1			
Brazier & Whittemore . . . . .			2				
James C. Davis . . . . .			1				
Bay State Glass Co. . . . .					1		
F. Draper & Co. . . . .		1					
Eagle Sugar Refinery . . . . .					1		
Cambridge Stamping Co. . . . .			1	1			
W. A. Jackson & Co. . . . .				1			
George Woods & Co. . . . .				1			
Prospect House . . . . .				1			
Union Railway Co. . . . .					1		



During the year the premises of each water-taker have been visited, and the examinations made have resulted in the correction of the rates to the advantage of the city.

Respectfully submitted.

A. F. FIFIELD,  
*Registrar*

# REPORT

OF THE

## TRUSTEES OF THE SINKING FUND OF THE CAM- BRIDGE WATER WORKS.

**THE** undersigned, in compliance with the request of the City Council, herewith submit a detailed statement of the formation and present state of the Sinking Fund of the Cambridge Water Works, with the date and amount of each addition, taken from the books of the City Treasurer as made up to June 30, 1869.

It appears that the Water Works were purchased by the city, April 28, 1865; and that the Sinking Fund account was first opened for the year ending June 30, 1866, as follows; viz.:—

*June 30, 1866.*

Received of the Water Registrar, for rates and supplies, &c., for the year ending this day . . . .	\$47,855.48
Less amount of expense for care and repair during the same period . .	41,929.76
	<hr/>
Balance of earnings over expense	\$5,925.72
Interest on cash balances in Treasury during the year . . . . .	442.05
	<hr/>
Amount passed to the credit of said Fund, June 30, 1866 . . . . .	\$6,367.77

*June 30, 1867.*

Received of the Water Registrar, for rates and supplies, &c., for the year ending this day . . . . .	\$56,056.57
--	-------------

Amounts brought forward . . .	\$56,056.57	\$6,367.77
Less amount of expense for care and repair during the same period . . .	\$44,030.96	
Discount on bonds sold during the year 1866	1,067.21	
	<hr/>	45,098.17

Balance of earnings over expense	\$10,958.40
Interest on cash balances in Treasury during the year . . . . .	1,227.66
One year's interest on Fund \$6,367.77 to this date . . . . .	382.06

Amount passed to the credit of  
said Fund, June 30, 1867 . . . . . \$12,568.13

*June 30, 1868.*

Received of the Water Registrar, for rates and supplies, &c., for the year ending this day . . . . .	\$65,040.66
Interest on cash balances during the year	3,215.58
	<hr/>
	\$68,256.24

Less amount of expense for care and repair during the same period . . .	\$61,395.39
Discount on bonds sold during the year 1867	2,809.11
	<hr/>
	64,204.50

Balance of earnings over expense (Interest on \$382.06, see below.)	\$4,051.74
One year's interest on Fund to this date \$18,553.83 . . . . .	1,113.23
	<hr/>
	\$5,164.97

Amount carried forward : : . . . . . \$18,935.83

Amount brought forward . . . . .	\$18,935.89
Amount passed to the credit of said Fund, June 30, 1868 . . . . .	5,164.97
Amount of Fund, June 30, 1868, as per account . . . . .	\$24,100.86

June 30, 1869.

Received of the Water Registrar, for rates and supplies, &c., for the year ending this day . . . . .	\$80,434.56
Less amount of expense for care and repairs, &c., and interest on bonds during the same period . . . . .	77,942.82
Balance of earnings over expense	\$2,491.74
Interest on \$382.06 for one year, \$22.92; and interest on \$22.92 for one year, \$1.38 (Tem. Loan)	24.30
Interest on bonds . . . . .	\$720.00
Interest on Temporary Loan	389.54
	<u>1,109.54</u>
Amount passed to the credit of said Fund, June 30, 1869 . . . . .	3,625.58
Amount of Sinking Fund, as per Treasurer's books, June 30, 1869 . . . . .	\$27,726.44
Amount of accrued interest on bonds to June 30, payable Oct. 1 . . . . .	360.00
Actual value of Sinking Fund, June 30, 1869	\$28,086.44

June 30, 1869.

Said Fund is invested as follows; viz.:—

Bonds of the City of Cambridge	\$24,000.00
Temporary Loan of the city . . . . .	3,726.44
	<u>\$27,726.44</u>

By the statute it is required that a sum not less than one per cent. of the cost of the Works shall be added annually to this Fund. Under this provision, the estimated amount required from

April 30, 1865, to June 30, 1869, including interest upon the same is . . . . .	\$20,902.63
Value of Sinking Fund, June 30, 1869 . . . . .	28,086.44
Excess of Fund over statute requirements . . . . .	7,183.81

Amount required annually is as follows ; viz. : —

1866	One per cent. on the cost is \$3,019 51, Amt. passed to Fund	\$5,925 72
1867.	" " " " " 3,838 54, " " " "	10,958 40
1868.	" " " " " 5,322 73; " " " "	4,051.74
1869	" " " " " 6,742.48; " " " "	2,491 74
		\$18,923.26
		\$23,427 60
		18,923.26

Excess over one per cent . . . . . \$4,504 34

From the above it will be seen, that the amount added to this Fund for the past two years has not been equal to the amount named in the statute. The sums added in 1866 and 1867 exceeded the percentage required. The heavy outlay for the last two years has not permitted the passing of the amount of one per cent. to the Fund, with the present water-rates. In 1868 the sum of \$175,000 was expended, and in 1869 the sum of \$112,000, for the extension of the Works : making an increase of interest to be paid from the receipts of upwards of \$17,000 annually, which has been done with the result above stated. The Works are now completed, excepting the yearly extension of pipes ; which expense will for the future be greatly reduced. Probably not more than \$50,000 will be required for 1870. The earnings will then show immediately an excess of the amount named in the statute, which will more than make up any present deficiency for the past two years. The rates have been revised by the City Council the present year, and meters are being introduced into the large establishments of consumers ; showing, in every case, an increased gain of receipts, which, we believe, will in the future allow an increase yearly to be added to this fund far beyond the amount specified.

All of which is respectfully submitted.

CHAS. H. SAUNDERS,	} Trustees	
HENRY W. MUZZEY.		
JOSEPH WHITNEY,		
		of the
		Sinking Fund of
		Water Works.

CAMBRIDGE, Nov. 30, 1869





THE  
SIXTH ANNUAL REPORT  
OF THE  
CAMBRIDGE WATER BOARD  
TO THE  
CITY COUNCIL,  
TOGETHER WITH THE  
REPORT OF THE REGISTRAR AND SUPERINTENDENT,  
FOR THE YEAR 1870.



CAMBRIDGE:  
PRESS OF JOHN WILSON AND SON  
1871.





THE  
SIXTH ANNUAL REPORT 32024  
OF THE  
CAMBRIDGE WATER BOARD  
TO THE  
CITY COUNCIL,  
TOGETHER WITH THE  
REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
FOR THE YEAR 1870.



CAMBRIDGE:  
PRESS OF JOHN WILSON AND SON.  
1871.

# CAMBRIDGE WATER BOARD.

1870.

---

JOHN SARGENT . . . . . *President.*  
ROBERT DOUGLASS . . . . . *President pro tem.*  
JUSTIN A. JACOBS . . . . . *Clerk.*

## Members of Board.

THE MAYOR,  
PRESIDENT OF COMMON COUNCIL, } *ex officio.*  
SAMUEL SLOCOMB.  
JOHN SARGENT.  
CHESTER W. KINGSLEY.  
A. K. P. WELCH.  
ROBERT DOUGLASS.

ABIEL F. FIFIELD, *Water Registrar.*  
SAMUEL W. DUDLEY, *Superintendent of Works.*

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## Trustees of Sinking Fund of Water Loan.

THE MAYOR,  
CITY TREASURER,  
PRESIDENT OF COMMON COUNCIL, } *ex officio.*

# REPORT

## OF THE

### CAMBRIDGE WATER BOARD.

In obedience to the requisitions of an ordinance of the City, the Cambridge Water Board herewith present to the City Council their sixth

#### ANNUAL REPORT,

Embracing a statement of the extension of the Works during the present year, with the increase of the extension account therefor, their present condition, and an account of the receipts and expenditures, demonstrating that the additional receipts fully cover the additional expense for their enlargement.

The net cost of the Works, Nov. 30, 1869,	
was . . . . .	\$828,100.69
Expended for extension of the Works for the year	
ending Nov. 30, 1870 . . . . .	56,906.46
Total cost of the Works, Nov. 30, 1870 . . . . .	\$885,007.15

Receipts from water rates for the year ending Nov.	
30, 1870 . . . . .	\$92,606.95
Receipts from water rates for the year ending Nov.	
30, 1869 . . . . .	76,149.30
Increase of water rates in 1870 . . . . .	\$16,457.65

Receipts from all sources for the year ending Nov.	
30, 1870 . . . . .	\$109,498.96
Receipts from all sources for the year ending Nov.	
30, 1869 . . . . .	91,347.92
Increase of receipts in 1870 . . . . .	\$18,151.04

Total Cash Receipts for the year ending Nov. 30,	
1870 . . . . .	\$109,498.96
Expended for care and repair account	\$19,014.43
Expended on supply account . . .	14,999.57
Interest . . . . .	49,704.00
	<hr/>
	83,718.00
Balance unexpended . . . . .	<hr/>
	\$25,780.96

For a more detailed statement of the financial condition of the Works, we would refer you to the Report of the Water Registrar.

The Sinking Fund established for the final liquidation of the Water Bonds amounted on the first day of July, 1870, to \$59,673.62.

During the past summer, Mr. Samuel W. Dudley was appointed Superintendent of the Works; and we are happy to say that he has more than met our highest anticipations, and we trust the City will long enjoy his eminently valuable services.

During the present month a change has been made in the Engineer at the engine-house; and the Works have been placed in charge of Mr. Edwin C. Brooks, who comes to us very highly recommended. He has not been in charge of the Works long enough to become entirely familiar with the whole routine of duty, yet we feel confident that he will meet the expectations not only of the Water Board, but of the City Council.

In the progress of the work the present year we have laid of

12-inch pipe . . . . .	2,373	feet
10-inch pipe . . . . .	63	"
8-inch pipe . . . . .	1,605	"
6-inch pipe . . . . .	14,398	"
4-inch pipe . . . . .	15,031 $\frac{1}{2}$	"
3-inch pipe . . . . .	1,530	"
2-inch pipe . . . . .	1,274	"
1 $\frac{1}{2}$ -inch pipe . . . . .	180	"
1 $\frac{1}{4}$ -inch pipe . . . . .	148	"
Total amount of pipe laid, 36,647 $\frac{1}{2}$ feet, or about 7 miles.		

The Report of the Superintendent gives a full description of the location of the pipes and of all branches of work done the present year, with a schedule of all the personal property belonging to the Works.

A new gate and gate-house have been built at the outlet of Fresh Pond, and flash boards have been erected on Alewife Brook where it passes under the Lexington Branch Railroad. These flash boards were rendered necessary, not only to secure the water flowing from Spy and Little Ponds by conducting it into Fresh Pond, but to enable the fish to escape from the pond to the ocean. There had been no water flowing from Fresh Pond for several months, while there was a constant flow from Spy and Little Ponds. By the dam at the railroad crossing the tide is effectually shut out from all the ponds, and the water from Spy and Little Ponds is carried directly into Fresh Pond. The result has been to secure a strong current of water into Fresh Pond, thus enabling the fish to escape, and, besides furnishing us our daily supply, raising the water in the pond about one half an inch per day.

The extreme drought of the past summer, which was a source of alarm to many of our citizens, and caused some anxiety in the minds of the Water Board, has nevertheless been the means of increasing our confidence in the capacity of Fresh, Spy, and Little Ponds to meet the demands of the City in any emergency.

Fresh Pond covers one hundred and eighty-three acres, and the area is increased, when the water is the highest, to about two hundred acres. Mr. F. M. Bardwell, by whom observations were made at Fresh Pond from Sept. 20, to Oct. 12, 1855, reports the discharge from Fresh Pond as averaging one million seven hundred and twenty-five thousand gallons per day. Careful observations were again made by scientific gentlemen in 1856, who reported the water-shed of Fresh Pond at twelve hundred acres. This tract, deducting the area of the pond itself, the evaporation from which is supposed to be equal to the rain-fall upon it, would give for the year 1856, during which the total rain-fall was fifty-four inches, one million six hundred and thirty-four thousand two hundred and fifty-six gallons per day. This calculation was based upon the supposition that four-tenths of the rain-fall finds its way



into the pond. "During the eight months, commencing March 24, 1856, during which these observations were made, the daily average discharge was two million three hundred and one thousand nine hundred forty-seven gallons."

"During the same period of time they report the average daily discharge from Spy and Little Ponds and Wellington Brook to have been, upon the same bases of water-shed and rain-fall, seven million four hundred and ninety-three thousand one hundred fifty-two gallons;" while the actual daily discharge by measurement was nine million seven hundred and twenty-eight thousand six hundred twenty-nine gallons. This estimate shows that the three ponds, estimating their water-shed to be the limit of their capacity, are capable of yielding some eight million gallons per day, and that about three-fourths of this quantity is to be furnished from Spy and Little Ponds. The difference between high and low water in 1856 was 2.11 feet. As we have a right to hold the water in the ponds to high water-mark, this power would enable us to store in Fresh Pond about one hundred twenty-six million four hundred thousand gallons, and as much more in Spy and Little Ponds.

If but one half of this amount be secured, it would be equal to about sixty days' supply at our present consumption.

But the experience of the past summer shows conclusively that the above estimate from the water-shed and rain-fall gives but a very imperfect idea of the real capacity of the ponds, clearly demonstrating that they are fed from a fountain independent of the rain-fall and water-shed for any given time, defying all our powers of computation.

On the second day of July the gate at the outlet of Fresh Pond was closed, and remained closed until November 21st, a period of one hundred and forty-one days. During this time the loss of water in the pond was  $30\frac{1}{2}$  inches. When the pond is at an average height, it will produce 3,600,000 gallons per inch, but the surface of the water in the pond was so reduced the present year that it would only yield some 3,000,000 gallons. Estimating the water in the pond at 3,000,000 gallons per inch, we find a loss of 91,200,000 gallons. During the same period of time the rain-fall amounted to 9.85 inches. This, estimating that the evaporation from the pond is

equal to the rain-fall upon its surface and that four-tenths from its water-shed reaches the pond, which is the usual estimate, would give us 12.31 inches of water upon the pond, equal to forty-six million nine hundred and thirty thousand gallons, showing the total amount of water furnished by the rain-fall and the fall of water upon the pond to have been 138,130,000 gallons during the time the outlet was closed; while we had drawn from Fresh Pond during the same period 268,752,292 gallons, being an excess of 130,622,292 gallons, or nearly twice the amount the pond was capable of yielding, estimating its capacity by the rain-fall and water-shed for the same period of time. In the foregoing estimate we have assumed the general average for evaporation and absorption; but we have no doubt that in a very dry summer, like the past, the evaporation and absorption would greatly exceed that of an ordinary season; and so limited was the rain-fall for a large portion of this time that it produced no apparent effect upon the water in the pond. The rain-fall was as follows:—

July,	1.26 inches,	and the pond fell	$7\frac{5}{25}$ inches.
August,	2.03	“ “ “ “ “	$7\frac{17}{25}$ “
September,	1.81	“ “ “ “ “	$8\frac{1}{25}$ “
October,	3.76	“ “ “ “ “	$3\frac{12}{25}$ “
To Nov. 21,	1.05	“ “ “ “ “	$3\frac{15}{25}$ “

The only apparent effect upon the pond from the rain-fall appears to be from that in October. Some estimate may now be formed of the capacity of Fresh, Spy, and Little Ponds to meet the future wants of our rapidly growing city. The water-shed of Fresh Pond, exclusive of the surface of the pond, is about one thousand acres. The water-shed of the three ponds is about five thousand acres. Fresh Pond has yielded during the past summer about two million gallons per day. If the water from all three of the ponds had been secured, they would have yielded some nine million gallons per day. If we estimate the whole yield at only seven million gallons per day, that would allow for one hundred and fifty thousand inhabitants twenty-five gallons per day for each individual, leaving two million five hundred thousand gallons for



manufacturing and other purposes. We are of the opinion that the time has arrived when another set of pumps like the last should be obtained. The capacity of the old pumps is not sufficient to furnish the amount of water already required, and cannot therefore be relied upon with safety, except in very limited cases of emergency. The full capacity of the old pumps is much less than the daily consumption the present year; and as we have added more than six hundred new takers, the daily consumption will be largely increased hereafter; and as it will take nearly a year to procure a new set of pumps, completed ready for use, we deem it unwise to delay the matter any longer, and shall at the proper time ask an appropriation for that purpose.

All which is respectfully submitted.

JOHN SARGENT,  
H. R. HARDING,  
ROBERT DOUGLASS,  
SAMUEL SLOCOMB,  
C. W. KINGSLEY,  
JOSEPH H. CONVERSE,

} *Cambridge  
Water Board.*

CAMBRIDGE, Dec. 14, 1870.

# REPORT

OF

## THE WATER REGISTRAR.

---

WATER REGISTRAR'S OFFICE, }  
CAMBRIDGE, Dec. 1, 1870. }

*To the Cambridge Water Board:—*

GENTLEMEN,—The Water Registrar, in compliance with the provisions of the ordinance for the care and management of the Cambridge Water Works, respectfully submits his Annual Report for the year ending Nov. 30, 1870.

### Receipts.

Water-rates . . . . .	\$92,606.95
Supply account for service pipe, laying, repairing, &c. . . . .	16,382.93
From Engineer for rent of house . . . . .	150.00
From sales of old iron . . . . .	359.08

Total cash receipts from all sources . . . . . \$109,498.96

All of which has been paid into the City Treasury.

The increased amount of income for the financial year ending Nov. 30, 1870, over the previous year, is \$18,151.04

### Expenditures.

The expenditures for the care and management of the Works for the year ending Nov. 30, 1870, have been as follows:—

For care and repairs . . . . .	\$7,572.92
For pumping service . . . . .	7,245.66
For office expenses . . . . .	4,195.85

Total amount . . . . . \$19,014.43

The expenditure on the extension of the Works for the year ending Nov. 30, 1870, was \$56,906.46

The expenditure on supply account was 14,999.57

**Supply Account.**

Cash received on above account . . . . .	\$16,382.93	
Now due . . . . .	8,511.49	
		<u>\$24,894.42</u>
There was reported due Dec. 1, 1869 . . . . .	\$6,878.13	
Since expended . . . . .	14,999.57	
		<u>21,877.70</u>
Balance in favor of account . . . . .		\$3,016.72

During the year the water has been turned off for non-payment of rates fifty-one times. Of this number forty-three have been let on, leaving a balance of eight still remaining off.

The following table exhibits the yearly revenue received from the sale of Fresh Pond Water since the purchase of the Works by the City : —

From April 28, 1865, to Dec. 1, 1865 . . . . .	\$32,367.19
“ Dec. 1, 1865, “ 1866 . . . . .	40,073.27
“ “ 1866, “ 1867 . . . . .	52,733.62
“ “ 1867, “ 1868 . . . . .	63,747.42
“ “ 1868, “ 1869 . . . . .	76,149.30
“ “ 1869, “ 1870 . . . . .	92,606.95
	<u>\$357,677.75</u>

**STATEMENT**

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, &c., SUPPLIED WITH FRESH POND WATER TO DEC. 1, 1870.

5354 Families.
426 Hand Hose.
422 Stables.
241 Fire Hydrants.
133 Stores and Offices.
62 Stationary Engines.
42 Shops.

35	Boarding-houses.
28	Reservoirs.
27	Saloons.
21	School-houses.
20	Barber Shops.
20	Meat Markets.
18	Soap Works.
12	College Buildings.
11	Bake-houses.
10	Public Halls.
10	Public Drinking Fountains.
10	Machine Shops.
9	Greenhouses.
9	Churches.
9	Furniture Manufactories.
8	Lumber Wharves.
7	Coal Wharves.
7	Livery Stables.
7	Printing Establishments.
7	Blacksmith Shops.
6	Billiard Halls.
6	Banks.
6	Fish Markets.
5	Book Binderies.
5	Stone Yards.
5	Car Stables.
5	Lodging-houses.
4	Hotels.
4	Club Rooms.
4	Police Stations.
4	Post Offices.
4	Fire Engine-houses.
4	Glass Manufactories.
4	Nurseries.
4	Private Fountains.
4	Photograph Rooms.
3	Cattle Yards.

- 3 Laboratories.
- 3 Planing Mills.
- 3 Carriage Manufactories.
- 3 Stereotype Foundries.
- 3 Iron Foundries.
- 2 Private Schools.
- 2 Tallow Factories.
- 2 Cooper Shops.
- 2 I. O. of O. F. Halls.
- 2 City Stables.
- 2 Railroad Depots.
- 2 Pastures.
- 2 Masonic Halls.
- 2 Oil Factories.
- 2 Slaughter-houses.
- 2 Laundries.
- 2 Cigar Manufactories.
- 2 Brush Factories.
- 2 Tin Ware Factories.
- 2 Bacon Works.
- 2 Box Manufactories.
- 2 Organ Manufactories.
- 2 Carpenter Shops.
- 1 Almshouse.
- 1 Brass Foundry.
- 1 Bone Factory.
- 1 Brewery.
- 1 Boiler Manufactory.
- 1 Brick Yard.
- 1 Currier Shop.
- 1 Coffin Manufactory.
- 1 City Hall.
- 1 City Wharf.
- 1 Confectionery Manufactory.
- 1 Chemical Works.
- 1 Cemetery.
- 1 Divinity Hall.

- 1 Drain Pipe Manufactory.
- 1 Distillery.
- 1 Frame and Moulding Manufactory.
- 1 G. A. R. Hall.
- 1 Gas Works.
- 1 Gymnasium.
- 1 Henery.
- 1 House of Correction.
- 1 Lead Pipe Works.
- 1 Lard Works.
- 1 Museum of Comparative Zoölogy.
- 1 Marble Works.
- 1 Public Library.
- 1 Paper Collar Manufactory.
- 1 Rolling Mill.
- 1 State Arsenal.
- 1 Sausage Manufactory.
- 1 Skating Rink.
- 1 Sugar Refinery.
- 1 Swine Yard.
- 1 Vinegar Factory.

During the year thirteen meters have been applied to the premises of water takers, making the total number now in use sixty-eight. They are attached to a variety of establishments, as follows : —

WHERE ATTACHED.	SIZE OF METERS.					
	$\frac{1}{4}$ inch.	$\frac{1}{2}$ inch.	1 inch.	1 $\frac{1}{2}$ inch.	2 inch.	3 inch.
Bay State Glass Co.	.	.	.	.	1	.
Boston and Lowell Railroad Co.	.	.	1	.	3	.
Badger & Batchelder	.	.	.	1	.	.
Braman, Shaw, & Co.	.	.	.	1	.	.
Metallic Compression Casting Co.	.	.	2	.	.	.
House of Correction	.	.	.	.	1	.
John K. Hodgdon	.	.	.	.	1	.
Boston Chemical Works	.	.	.	.	1	.
Beal & Hooper	.	.	.	.	1	.
James McIntosh	.	.	1	.	.	.
North, Meriam, & Co.	.	.	.	.	1	.
J. P. Squire & Co.	.	1	.	.	1	.
Doe & Charmois	.	.	.	1	.	.
New England Glass Co.	.	.	.	.	1	.
Eagle Sugar Refinery	.	.	.	.	1	.
F. Draper & Co.	.	1	.	.	.	.
F. Geldowsky	.	.	.	1	.	.
Woodbury & Co.	.	.	.	.	1	.
Welch, Bigelow, & Co.	.	1	.	.	.	.
O. S. Ballock	.	.	1	.	.	.
Thayer Club	.	1	.	.	.	.
Shawmut Iron Works	■	.	.	.	.	.
Williamson & Bartlett	.	.	1	.	.	.
H. O. Houghton & Co.	.	1	.	.	.	.
Cambridge Laundry	■	.	.	.	.	.
C. L. Jones & Co.	.	.	1	.	.	.
Boston Silver Glass Co.	.	.	1	.	1	.
Union Glass Co.	1	.	2	.	.	.
Boston Rolling Mill	.	.	.	.	1	.
S. M. Cofran	.	.	.	.	1	.
Edmund Smith	.	.	1	.	.	.
John Wilson & Co.	.	.	1	.	.	.
Reversible Collar Co.	.	.	1	.	.	.
B. P. Clark & Co.	.	.	1	.	.	.
John Reardon & Sons	.	.	1	.	.	.
Boston Stamping and Manufacturing Co.	.	.	1	.	.	.
Little & Brown	.	.	1	.	.	.
Cambridge Gas Light Co.	.	.	.	.	.	1
Lyman Kinsley & Co.	.	.	.	.	1	.
George G. Page & Co.	.	.	1	.	.	.
Novelty Box Works	.	.	1	.	.	.
Curtis Davis	.	.	.	1	.	.
Brazier & Whittamora	.	.	2	.	.	.
James C. Davis	.	.	1	.	.	.
George Woods & Co.	.	.	.	1	.	.
Cambridge Stamping and Manufacturing Co.	2	.	.	1	.	.
Prospect House	.	.	.	1	.	.
Henry Thayer & Co.	.	.	.	.	1	.
Hancock & Greely	1	.	.	.	.	.
H. M. Clark	1	.	.	.	.	.
James B. Kent	.	.	1	.	.	.
Cambridge Co-operative Housekeeping Association	1	.	.	.	.	.
T. S. Huckins	.	.	1	.	.	.
Union Railway Co.	1	.	.	.	.	.
Day & Collins	.	.	1	.	.	.
Joseph Boynton	1	.	.	.	.	.
Mount Auburn Corporation	.	.	1	.	.	.
Mason and Hamlin Organ Co.	.	.	1	.	.	.



During the past year every building supplied with water has been visited. It is the intention that this inspection shall be equally thorough the coming winter, in making an examination of the fixtures, that any leaks in service pipes may be stopped, and that the many abuses in the use of the water which have become manifest during the past few years may be corrected.

Respectfully submitted.

A. F. FIFIELD,

*Water Registrar.*

# REPORT

CONCERNING

## THE ACCOUNTS OF THE WATER REGISTRAR.

---

IN CAMBRIDGE WATER BOARD, }  
Dec. 13, 1870. }

THE Committee appointed to examine the accounts of the Water Registrar for the financial year ending Nov. 30, 1870, herewith submit the following

### REPORT :

Your Committee have examined the books and accounts of the Water Registrar, and compared them with the vouchers, and find that the same are correct in all respects.

Respectfully submitted,

SAMUEL SLOCOMB, }  
ROBERT DOUGLASS, } *Committee.*

# REPORT

OF THE

## SUPERINTENDENT OF THE WATER WORKS.

---

*To the Cambridge Water Board:—*

GENTLEMEN, — In compliance with the City ordinance, I herewith submit my Annual Report upon the general condition of the Water Works, for the year ending Nov. 30, 1870.

### **Pond.**

A new dam and gate-house have been built, the present season, at the outlet of the pond; a substantial flash board has been placed at the outlet of Spy Pond, near the Lexington Branch Railroad, and also one at the outlet of Fresh Pond, near the same point, and a channel has been cut through above the flash boards, to turn the water of Spy Pond into Fresh Pond. A wooden culvert, 18 inches by 12 inches, has been laid through the lower end of Spruce Street, to carry the filthy water from the Brick Yards below the flash boards.

### **Engine House.**

Every thing in and around the engine-house is in good order. An eight-inch pipe for conveying the exhaust steam has been laid from the boiler-room, under the railroad track, to the ditch on the east side of the pond; the ashes have been removed from the basement under the engine-house, and the walls on the inside have been banked up with clay, to dyke out the water. The roof of the engine-house, which was leaking badly, has been repaired, and is now perfectly tight; and lights of glass have been set in the windows, where any were found broken. There were 635,052,196 gallons of water pumped the past year, using 1,112,850 pounds of

coal. The average number of gallons pumped daily was 1,739,869, an average daily increase over the previous year of 122,384 gallons.

#### **Force Main.**

The force main has been in good order. Only two slight leaks at the joints have occurred on it during the year.

#### **Reservoirs.**

The reservoirs are in very good order. The joints of the cap-stones on both have been leaded, owing to the crumbling of the cement joints. In October, the large reservoir was thoroughly cleaned out, and all necessary repairs on it were made.

#### **Distribution Pipes.**

The distribution pipes, of which there are now about sixty miles, are in good condition. Of the leaks that have occurred in pipes, — seventy were at joints; twenty-four, at driving-cocks in main; twelve, at service pipes; nine, defective pipes; six, at aqueduct log; four, at cement pipes; three, at fire hydrants; three, at blow-off cocks; two, struck by picks; two, at plugs in ends of pipes; one, by settling of earth. Total, 136. The greatest number of leaks was on the old three and four-inch pipes, where joints were made of cement.

During the year the water was blown off from the ends of pipes sixty-eight times.

#### **Gates.**

There have been seventy-three new gates, set mostly on new lines of pipe. There are some sections of the city where more gates are needed on the old lines of pipe, as they have been frequently shut off the past year to repair leaks and to connect new lines of pipe, which causes considerable dissatisfaction among the takers. Sixty gate-boxes have been raised or lowered to conform to the new grades of streets, and six boxes have been taken out and replaced by new ones.

#### **Hydrants.**

The hydrants are all in good order throughout the city. During the year fifty have been added to the Works, most of them on new

lines of pipe. Nine hydrants have been raised entire, and fifteen boxes have been raised or lowered, as the grades of the streets required. Three hydrant boxes have been taken out, and replaced by new ones; and three hydrants that were broken have been removed, and new ones set in their places.

#### Meters.

Thirteen meters have been applied to the premises of water takers, making the total number now in use sixty-eight. Of this number,—ten are  $\frac{5}{8}$ -inch; five,  $\frac{3}{4}$ -inch; twenty-seven, 1-inch; seven,  $1\frac{1}{2}$ -inch; eighteen, 2-inch; and one, 3-inch size. They are attached to a variety of manufacturing establishments.

#### Drinking Fountains.

Ten drinking fountains have been set in different sections of the city as follows:—

On North Avenue.

In Cambridge Common.

“ Harvard Square.

“ Brattle Square.

“ Haymarket Square.

At Junction of Main and Front Streets.

“ “ Cambridge and Hampshire Streets.

On Court Street, between Main and Broadway.

“ East Street, between Cambridge and Bridge.

“ Cambridge Street, near Fifth.

They are quite extensively used, and give general satisfaction to the public. Quite a large expenditure has been incurred in digging up and resetting some of them, where mischievous boys have put stones and sticks into them, obstructing the flow of water. By actual measurement, it has been found that the discharge from each fountain was 2,400 gallons for each twenty-four hours, and that the daily consumption for the ten fountains was twenty-four thousand gallons.

## STATEMENT OF SERVICE PIPE LAID IN 1870.

Diameter in inches.	Number of Pipes.	Length in Feet.	TOTALS.	
			Number of Pipes.	Length in Feet
2	8	288	8	288
1½	6	1,051	6	1,051
1½	9	963	9	963
1	40	3,302	40	3,302
¾	560	28,775	560	28,775
Aggregate . . . . .			618	34,874
Making the total number of supply pipes . . . . .				4,191.

STATEMENT OF LOCATION, SIZE, AND NUMBER OF FEET OF  
PIPE LAID IN 1870.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Arlington . . . . .	4	641
Acorn . . . . .	4	130
Amory . . . . .	4	517
Allston . . . . .	4	108
Antrim . . . . .	6	121
Allston . . . . .	8	191
Arlington . . . . .	6	366
At Engine House . . . . .	8	85
Brighton . . . . .	4	233
Brookline . . . . .	6	445
Beech . . . . .	6	428
Brattle . . . . .	4	45
Brattle . . . . .	6	976
Brattle . . . . .	8	1208
Bridge and Water . . . . .	6	569
Bedford . . . . .	4	240
Buckingham . . . . .	4	86
Banks . . . . .	4	842
Bristol . . . . .	8	84
Concord Avenue . . . . .	6	1183
Cedar and Lane . . . . .	6	1016
Cedar and Lane . . . . .	4	272
Crane . . . . .	4	474
Concord Avenue . . . . .	4	21½
College Grounds . . . . .	4	897
Church . . . . .	4	120
Clark . . . . .	8	68
Dyke . . . . .	4	127
Dover . . . . .	8	90

## STATEMENT OF LOCATION, SIZE, &amp;c. (continued).

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Eustis Place . . . . .	8	265
Fourth . . . . .	4	225
Fayerweather . . . . .	12	725
Fayerweather . . . . .	4	875
Fresh Pond Lane . . . . .	4	860
Flagg . . . . .	4	808
Frisbie Place . . . . .	4	815
Fourth and Otis . . . . .	4	15
Fourth and Otis . . . . .	8	12
Follen . . . . .	8	180
Garden . . . . .	6	264
Garden . . . . .	4	12
Gore . . . . .	4	4
Hampshire . . . . .	4	54
Howard . . . . .	4	807
Horace . . . . .	4	274
Hampshire . . . . .	12	109
Hampshire . . . . .	6	957
Houghton . . . . .	6	240
Irving Court . . . . .	8	160
Jay . . . . .	4	151
Jefferson and Rideout . . . . .	4	588
Kinnard . . . . .	4	401
Maple Avenue . . . . .	6	591
Maple Avenue . . . . .	4	522
Mount Auburn (East of Brighton) . . . . .	4	270
Mount Auburn (Cemetery to Railroad Stable) . . . . .	4	995
Mount Auburn (Cemetery to Railroad Stable) . . . . .	6	76
Mount Auburn . . . . .	6	814
Mount Auburn . . . . .	4	18
Magazine . . . . .	6	608
Mill . . . . .	4	644
McCabe Place . . . . .	8	222
Norfolk . . . . .	4	214
Norfolk . . . . .	6	684
Norfolk . . . . .	8	70
Ninth . . . . .	6	176
North Avenue . . . . .	6	1637
North Avenue . . . . .	4	68
Oxford . . . . .	12	1034
Oxford . . . . .	10	68
Oxford . . . . .	8	812
Oxford . . . . .	4	281
Orchard . . . . .	6	858
Otis . . . . .	4	150



## :      TEMENT OF LOCATION, SIZE, &amp;c. (continued).

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Perry . . . . .	4	180
Putnam . . . . .	4	520
Putnam Place . . . . .	4	291
Prescott . . . . .	4	226
Prospect . . . . .	4	75
Pearl at East Perry . . . . .	4	35
Pine . . . . .	4	622
Porter . . . . .	4	286
Reservoir . . . . .	12	506
Rideout . . . . .	4	162
Roseland . . . . .	4	96
Roseland . . . . .	8	117
Sparks . . . . .	6	750
Sparks . . . . .	4	56
Somerset Place . . . . .	1½	180
Sparks Street Court . . . . .	4	800
Sparks Street Court . . . . .	8	18
Spring and Second . . . . .	4	35
Thorndike . . . . .	4	49
Tannery Lane . . . . .	2	1274
Thankful Court . . . . .	1½	148
Tuttle . . . . .	6	456
Tuttle . . . . .	4	8
Third and Gore . . . . .	8	28
Third and Thorndike . . . . .	8	41
Vine . . . . .	4	802
Winthrop . . . . .	4	228
Wallace . . . . .	4	225
Ward . . . . .	4	456
Willard . . . . .	6	826
Willard . . . . .	4	18
Willow . . . . .	4	332
Wyeth . . . . .	6	720
Wyeth . . . . .	4	14
Ware . . . . .	4	828
Ware . . . . .	8	44
Washington Avenue . . . . .	6	194

## GATES.

IN WHAT STREET.	Number.	Diameter in Inches.
Acorn . . . . .	1	4
Allston . . . . .	1	8
Arlington . . . . .	1	6
Arlington . . . . .	1	4
Brookline . . . . .	1	6
Beech . . . . .	1	6
Brattle . . . . .	1	6
Brattle . . . . .	1	4
Brattle . . . . .	1	8
Bridge and Water . . . . .	1	4
Bridge and Water . . . . .	1	8
Banks . . . . .	1	4
Bristol . . . . .	1	8
Crane . . . . .	1	4
Concord Avenue . . . . .	1	6
Fayerweather . . . . .	1	12
Fayerweather . . . . .	1	4
Fresh Pond Lane . . . . .	1	4
Frisbie Place . . . . .	1	4
Fourth and Otis . . . . .	1	4
Fourth and Otis . . . . .	1	8
Gore . . . . .	1	4
Howard . . . . .	1	4
Hampshire . . . . .	1	6
Irving Court . . . . .	1	8
Kinnard . . . . .	1	4
Maple Avenue . . . . .	1	6
Mount Auburn . . . . .	1	4
Mount Auburn . . . . .	1	6
Magazine . . . . .	1	6
Mill . . . . .	1	4
McCabe Place . . . . .	1	8
Norfolk . . . . .	8	4
Norfolk . . . . .	1	8
Ninth . . . . .	1	6
North Avenue . . . . .	2	6
North Avenue . . . . .	1	4
Oxford . . . . .	1	12
Oxford . . . . .	5	6
Oxford . . . . .	1	8
Oxford . . . . .	1	4
Putnam . . . . .	1	4
Prescott . . . . .	1	4
Prospect . . . . .	1	4
Pearl at Auburn . . . . .	1	4

## GATES (continued).

IN WHAT STREET.	Number.	Diameter in inches.
Pine . . . . .	2	4
Porter . . . . .	1	4
Quincy . . . . .	1	4
Reservoir . . . . .	1	12
Reservoir . . . . .	1	4
Second at Court . . . . .	1	8
Sacramento . . . . .	1	6
Thorndike . . . . .	1	4
Tuttle . . . . .	1	6
Third and Gore . . . . .	1	8
Third and Thorndike . . . . .	1	8
Vine . . . . .	2	4
Winthrop . . . . .	1	4
Winthrop . . . . .	1	8
Wallace . . . . .	1	4
Ward . . . . .	1	4
Willard . . . . .	2	6
Willow . . . . .	1	4

## BLOW-OFF PIPES.

IN WHAT STREET.	Number.	Diameter in inches.
Acorn . . . . .	1	1½
Allaton . . . . .	2	1½
Antrim . . . . .	1	1½
Brighton . . . . .	1	1½
Brookline . . . . .	1	1½
Beech . . . . .	1	1½
Bedford . . . . .	1	1½
Buckingham . . . . .	1	1½
Concord Avenue . . . . .	1	1½
Cedar and Lane . . . . .	2	1½
Crane . . . . .	1	1½
College Grounds . . . . .	1	1½
Church . . . . .	1	1½
Clark . . . . .	1	1½
Dyke . . . . .	1	1½
Dover . . . . .	1	1½
Fayerweather . . . . .	1	1½
Fresh Pond Lane . . . . .	1	1½
Flagg . . . . .	1	1½
Howard . . . . .	1	1½
Horace . . . . .	1	1½

BLOW-OFF PIPES (continued).

IN WHAT STREET.	Number.	Diameter in Inches.
Houghton . . . . .	1	1½
Jay . . . . .	1	1½
Jefferson and Rideout . . . . .	1	1½
Kinnard . . . . .	1	1½
Mount Auburn . . . . .	1	1½
Mill . . . . .	1	1½
McCabe Place . . . . .	1	1½
Orchard . . . . .	1	1½
Perry . . . . .	1	1½
Putnam Place . . . . .	1	1½
Prescott . . . . .	1	1½
Rideout . . . . .	1	1½
Roseland . . . . .	1	1½
Sparks Street Court . . . . .	1	1½
Vine . . . . .	2	1½
Winthrop . . . . .	1	1½
Wallace . . . . .	1	1½
Willow . . . . .	1	1½
Washington Avenue . . . . .	1	1½

RECAPITULATION.

2,373 feet . . . . .	12-inch pipe.
63 feet . . . . .	10-inch pipe.
1,605 feet . . . . .	8-inch pipe.
14,398 feet . . . . .	6-inch pipe.
15,031½ feet . . . . .	4-inch pipe.
1,530 feet . . . . .	3-inch pipe.
1,274 feet . . . . .	2-inch pipe.
180 feet . . . . .	1½-inch pipe.
148 feet . . . . .	1¼-inch pipe.

GATES.

8 . . . . .	12-inch.
2 . . . . .	8-inch.
21 . . . . .	6-inch.
36 . . . . .	4-inch.
11 . . . . .	3-inch.

BLOW-OFF PIPES.

42 . . . . .	1½-inch.
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## STATEMENT

OF STOCK ON HAND, EXCLUSIVE OF TOOLS.

1	.	.	.	.	.	.	.	36-inch cast-iron pipe.
2	.	.	.	.	.	.	.	24-inch cast-iron pipes.
4	.	.	.	.	.	.	.	20-inch cast-iron pipes.
2	.	.	.	.	.	.	.	16-inch cast-iron pipes.
81	.	.	.	.	.	.	.	12-inch cast-iron pipes.
3	.	.	.	.	.	.	.	10-inch cast-iron pipes.
3	.	.	.	.	.	.	.	6-inch cast-iron pipes.
300	.	.	.	.	.	.	.	4-inch cast-iron pipes.
1	.	.	.	.	.	.	.	24 × 12-inch cast-iron T.
1	.	.	.	.	.	.	.	20 × 12-inch cast-iron T.
2	.	.	.	.	.	.	.	12 × 6-inch cast-iron T's.
5	.	.	.	.	.	.	.	12 × 4-inch cast-iron T's.
5	.	.	.	.	.	.	.	8 × 4-inch cast-iron T's.
15	.	.	.	.	.	.	.	6 × 6-inch cast-iron T's.
14	.	.	.	.	.	.	.	6 × 4-inch cast-iron T's.
10	.	.	.	.	.	.	.	4 × 4-inch cast-iron T's.
4	.	.	.	.	.	.	.	4 × 3-inch cast-iron T's.
4	.	.	.	.	.	.	.	4 × 3-inch cast-iron T's.
1	.	.	.	.	.	.	.	20 × 6-inch cast-iron cross.
5	.	.	.	.	.	.	.	12 × 6-inch cast-iron crosses.
6	.	.	.	.	.	.	.	12 × 4-inch cast-iron crosses.
1	.	.	.	.	.	.	.	8 × 6-inch cast-iron cross.
23	.	.	.	.	.	.	.	6 × 6-inch cast-iron crosses.
18	.	.	.	.	.	.	.	6 × 4-inch cast-iron crosses.
28	.	.	.	.	.	.	.	4 × 4-inch cast-iron crosses.
1	.	.	.	.	.	.	.	24-inch cast-iron sleeve, clamp.
1	.	.	.	.	.	.	.	20-inch cast-iron sleeve, clamp.
1	.	.	.	.	.	.	.	16-inch cast-iron sleeve, clamp.
4	.	.	.	.	.	.	.	12-inch cast-iron sleeves, clamp.
4	.	.	.	.	.	.	.	12-inch cast-iron sleeves, whole.
2	.	.	.	.	.	.	.	10-inch cast-iron sleeves, clamp.
6	.	.	.	.	.	.	.	10-inch cast-iron sleeves, whole.
8	.	.	.	.	.	.	.	8-inch cast-iron sleeves, whole.
10	.	.	.	.	.	.	.	6-inch cast-iron sleeves, whole.

6	.	.	.	.	.	.	.	4-inch cast-iron sleeves, clamp.
4	.	.	.	.	.	.	.	3-inch cast-iron sleeves, clamp.
2	.	.	.	.	.	.	.	12 to 8-inch cast-iron reducers.
5	.	.	.	.	.	.	.	12 to 6-inch cast-iron reducers.
3	.	.	.	.	.	.	.	10 to 8-inch cast-iron reducers.
3	.	.	.	.	.	.	.	10 to 6-inch cast-iron reducers.
24	.	.	.	.	.	.	.	6 to 4-inch cast-iron reducers.
5	.	.	.	.	.	.	.	6 to 3-inch cast-iron reducers.
3	.	.	.	.	.	.	.	12-inch cast-iron bends.
10	.	.	.	.	.	.	.	10-inch cast-iron bends.
2	.	.	.	.	.	.	.	6-inch cast-iron bends.
7	.	.	.	.	.	.	.	4-inch cast-iron bends.
3	.	.	.	.	.	.	.	3-inch cast-iron bends.
7	.	.	.	.	.	.	.	cast-iron caps.
6	.	.	.	.	.	.	.	cast-iron offset pipes.

20 gate-boxes, 14 hydrant bolts, 11 hydrant waste-cocks, 2 gate frames and covers, 2 2-inch stop-cock covers, 42 wooden plugs, different sizes, 3 blow-off goose necks, 25 pounds hemp-packing, 3 blow-off cocks, 14 blow-off pipes, 118 caps for blow-off pipes, 43 blow-off covers, 76 blow-off caps, lot of old iron, 3,000 feet treated lumber, 500 feet spruce lumber.

METERS. — In shop: 3 2-inch, 3  $1\frac{1}{2}$ -inch, 8 1-inch, 2  $\frac{3}{4}$ -inch, 5  $\frac{5}{8}$ -inch.

GALVANIZED PIPE. — 106 feet 2-inch pipe, 92 feet  $1\frac{1}{2}$ -inch ditto, 511 feet  $1\frac{1}{4}$ -inch ditto, 165 feet 1-inch ditto, 220 feet  $\frac{3}{4}$ -inch ditto, 315 feet  $\frac{1}{2}$ -inch ditto.

FOR SERVICE PIPE. — 2 2-inch cocks, 2  $1\frac{1}{2}$ -inch ditto, 3  $1\frac{1}{4}$ -inch ditto, 25 1-inch ditto, 1  $\frac{3}{4}$ -inch ditto, 1  $1\frac{1}{2}$ -inch corporation cock, 11  $\frac{3}{4}$ -inch ditto, 1  $1\frac{1}{4}$ -inch drive cock, 65  $\frac{3}{4}$ -inch ditto, 4 1-inch stop and waste cocks, 26  $\frac{3}{4}$ -inch ditto, 4  $\frac{1}{2}$ -inch ditto, 1 1-inch hose bibb cock, 11  $\frac{3}{4}$ -inch ditto, 39  $\frac{1}{2}$ -inch ditto, 12  $\frac{1}{4}$ -inch plain bibb cocks, 8  $\frac{3}{4}$ -inch garden hydrant cocks, 50 1-inch street elbows, 45  $\frac{3}{4}$ -inch ditto, 3 2-inch elbows, 24  $1\frac{1}{2}$ -inch ditto, 20  $1\frac{1}{4}$ -inch ditto, 12 1-inch ditto, 18  $\frac{3}{4}$ -inch ditto, 20  $\frac{1}{2}$ -inch ditto, 3 2-inch T's, 4  $2 \times \frac{3}{4}$ -inch ditto, 12  $1\frac{1}{2}$ -inch ditto, 16  $1\frac{1}{2} \times \frac{3}{4}$ -inch ditto, 12

1½-inch ditto, 12 1½ × ¾-inch ditto, 12 1-inch ditto, 18 1 × ¾-inch ditto, 39 ¾-inch ditto, 39 ¾ × ½-inch ditto, 20 ½-inch ditto, 2 2-inch iron unions, 4 1½-inch ditto, 4 1¼-inch ditto, 16 1-inch ditto, 18 ¾-inch ditto, 3 1-inch brass unions, 3 ¾-inch ditto, 15 1-inch air chambers, 29 ¾-inch ditto, 6 ½-inch ditto, 56 ¾-inch hose nipples, 9 1-inch solder nipples, 9 ¾-inch ditto, 40 2-inch couplings, 6 1½-inch ditto, 6 1¼-inch ditto, 5 1-inch ditto, 24 ¾-inch ditto, 40 ½-inch ditto, 12 2-inch nipples, 6 1½-inch ditto, 24 1¼-inch ditto, 36 1-inch ditto, 72 ¾-inch ditto, 84 ¾-inch ditto long, 26 guide pipes for stop-cocks, 123 covers for guide pipes, 12 shoes for guide pipes, 10 2 × 1½-inch bushings, 6 2 × 1¼-inch ditto, 4 2 × 1-inch ditto, 4 1½ × 1¼-inch ditto, 6 1½ × 1-inch ditto, 22 1 × ¾-inch ditto, 55 ¾ × ½-inch ditto, 29 1¼ × 1-inch ditto, 1 1¾-inch plug, 1 1½-inch ditto, 3 1¼-inch ditto, 12 1-inch ditto, 18 ¾-inch ditto, 22 ½-inch ditto, 3 ½-inch caps, 114 socket wrenches, 9 ditto long, 6 ditto with handles, 10 spring hydrant handles, 4 ½-inch bolts, with nuts and washers, 30 washers, 100 pounds lead.

#### TOOLS.

AT PIPE YARD. — 1 stove and water boiler, 1 large boom derrick, 1 hand-gear derrick, 1 small derrick, 4 sets caulking tools, 4 iron bars, 2 furnaces (complete), 3 sledge hammers, 3 axes, 3 hatchets, 10 lanterns, 3 tool chests, 10 wheelbarrows, 40 feet rope, 1 binding rope.

STABLE. — 1 horse, 1 Concord wagon, 1 truck wagon, 1 express wagon, 1 light wagon, 1 pung, 2 sets harness, 1 blanket, 1 halter, 2 whips.

IN SHOP. — 1 pair platform scales, 1 grindstone, 4 garden hydrant wrenches, 4 pairs rubber boots, ½ ton coal, 1 pair 3-inch pipe tongs, 1 pair 2½-inch ditto, 2 pair 2-inch ditto, 5 pair 1½-inch ditto, 4 pair 1¼-inch ditto, 2 pair 1-inch ditto, 1 pair ¾-inch ditto, 41 picks, 23 shovels, 10 ditto (worn out), 17 rammers, 19 gate-wrenches, 2 hydrant goose necks, 6 water-pails, 4 screw-drivers, 1 set drilling tools, 2 hatchets, 3 augers, 2 hand-carts, 3 bench vises, 5 crow-bars, 3 drill hooks, 2 ratchets, 2 plates and dies, 2



plates without dies, 3 pipe cutters, 5 monkey wrenches, 2 long handle fork hoes, 1 scroll plate with dies  $2 \times 1\frac{1}{4}$ -inch, 1 ditto  $1 \times \frac{1}{4}$ -inch, 1 set drills and taps  $2 \times \frac{1}{4}$ -inch, 3 hand saws, 5 drills, 2 taps, 2 paving hammers, 1 axe, 1 hand hammer, 1 ratchet wrench, 1 jointing set, 4 trowels, 4 oil cans, 3 window washers, 100 feet rubber hose, 3 tunnels, 1 gallon measure, 1 pipe brush 12 inch, 1 steel pipe scraper, 3 oil-feeders, 1 cask cement, 4 tape measures, 1 pitchfork, 2 spirit levels, 300 feet thawing pipes, 1 cylinder stove, 1 square, 8 chains, 20 pounds rubber packing, 2 nut wrenches, 1 copper pump, 2 snow-shovels, 1 beetle.

AT RESERVOIR. — 12 brooms (old), 4 water-pails, 3 iron bars, 3 gate wrenches, 6 iron settees, 1 step-ladder, 1 hammer, 1 oil-can and oil, 1 scoop net.

AT POND. — 2 globe lamps, 1 hand lamp, 1 lantern, 1 thermometer, 24 pounds rubber valves 9-inch, 9 pounds ditto 5-inch, 9 pounds gaskets 36-inch, 13 pounds Martin's packing, 5 pounds ditto (old), 10 pounds hemp packing, 26 pounds cotton waste, 12 pounds Rem's packing, 50 sheets rubber, 2 oil-cups, 1 endless chain fall, 2 coal hammers, 1 drill brace, 1 hand vise, 1 bench vise, 10 pounds Babbitt metal, 10 pounds soft solder, 50 pounds old felting, 2 sledge hammers, 9 eye bolts, 19 socket wrenches, 12 bolts 1-inch, 18 bolts  $1\frac{1}{4}$  to  $\frac{5}{8}$ -inch, set tools for shoulder heads, 2 jack screws, 2 die plates, 2 sets dies, 2 sets taps, 13 pair pipe tongs, 3 monkey wrenches, 12 iron wrenches, 2 ratchets, 1 breast drill, 12 cold chisels, 12 caulking tools, 20 drills, 24 old files, 6 iron bars, 12 valve springs, 150 pounds old bolts and nuts, 15 gallon oil-can and oil, 8 small oil-cans, 34 elbows (different sizes), 1 can and kerosene oil, 12 T's (different sizes), 30 nipples (different sizes), 1 firkin of tallow, 1 ladle, 5 globe valves, 3 rat-traps, 40 feet pipe (different sizes), 1 scythe, 6 bars soap, 5 pounds red lead, 8 pounds white lead, 2 hand planes, 3 hand saws, 1 square, 1 drawing knife, 12 chisels, 8 gouges, 10 bits, 1 bit stock, 3 broad adzes, lot emery paper, 4 pounds sheet brass, 8 pounds screws, 1 tool-chest, 3 water-pails, 1 water-pot, 1 pair platform scales, 1 wheelbarrow, 4 ladders, 1 forge and anvil, 8 pairs blacksmiths' tongs, 100 pounds bar iron, 2

pairs rubber boots, 1 axe, 7 shovels, 1 hoe, 1 ice chisel, 30 pounds lead, 5 pounds zinc, 100 feet rubber hose, 2 4-tine forks, 50 pounds cut nails, 10 yards felting, 2 fire hoes, 2 pokers, 2 bars, 2 brooms, 1 grindstone, 2 boats, 1 raft, 1 cast-iron roller, 1 stencil plate and letters, 376 tons soft coal, 45 tons hard coal.

**Respectfully submitted.**

**S. W. DUDLEY,**

*Superintendent.*





City of Cambridge.

III.

SEVENTH ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO THE

CITY COUNCIL,

COMPILED WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTENDENT  
AND OTHER DOCUMENTS,

FOR THE YEAR 1871



CAMBRIDGE:

Printed at the Fiberside Press.

1872



THE  
SEVENTH ANNUAL REPORT  
OF THE  
CAMBRIDGE WATER BOARD  
TO THE  
CITY COUNCIL,  
TOGETHER WITH THE  
REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
AND OTHER DOCUMENTS,  
FOR THE YEAR 1871.



CAMBRIDGE:  
Printed at the Riverside Press.  
1872. 62



CAMBRIDGE WATER BOARD.

1872.

J. WARREN MERRILL . . . . . *President.*

MEMBERS OF BOARD.

THE MAYOR,  
PRESIDENT OF COMMON COUNCIL, } *ex officiis,*  
CHESTER W. KINGSLEY,  
HENRY L. EUSTIS,  
GEORGE P. CARTER,  
SAMUEL SLOCOMB,  
J. WARREN MERRILL,  
JUSTIN A. JACOBS, *Clerk.*

ABIEL F. FIFIELD, *Water Registrar.*  
SAMUEL W. DUDLEY, *Superintendent of Works.*

TRUSTEES OF SINKING FUND OF WATER LOAN.

THE MAYOR,  
CITY TREASURER,  
PRESIDENT OF COMMON COUNCIL, } *ex officiis.*

# REPORT

## OF THE

### CAMBRIDGE WATER BOARD.

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In accordance with the requirements of the City Ordinance, the Cambridge Water Board herewith submit to the City Council their seventh Annual Report.

For the details of work done, expenditures and receipts, we would refer you to the Reports of the Water Registrar, and the Superintendent of the Water Works, presented to this Board this day, and herewith presented as a part of our Report.

The net cost of the Water Works to Nov. 30, 1870, as appears by our last Annual Report,	
was . . . . .	\$885,007.15
Add balance for extension account, Nov. 30, 1865	3,408.91
There have been expended for extension for the year ending Nov. 30, 1871 . . . . .	56,730.39
	<hr/>
Making cost of Water Works Nov. 30, 1871	\$945,146.45

The receipts for water rates for the year ending Nov. 30, 1871, were . . . . .	\$111,782.65
Receipts during same time in 1870 . . . . .	92,606.95
	<hr/>
Showing increase for 1871 . . . . .	\$19,175.70

The following statement will show the entire transactions on account of the Water Works for the year ending November 30, 1871.

**Received.**

Appropriations for Extension Account . . . . .	\$90,000.00
From water rates . . . . .	111,782.65
From Supply Account, and shutting off and letting on the water . . . . .	15,750.85
Sale of old iron pipe . . . . .	539.21
Balance of interest from City Treasurer on Tem- porary Loans . . . . .	2,578.27
Interest from Sinking Fund . . . . .	3,451.19
	<b>\$224,102.17</b>

**Expended.**

For Extension account . . . . .	\$56,730.39
" Care and repairs . . . . .	21,188.67
" Supply account . . . . .	15,342.36
" Interest paid on water debt to Nov. 30, 1871 .	53,304.00
Amount of Appropriation unexpended . . . . .	33,269.61
Balance showing gain in 1871 . . . . .	44,267.14
	<b>\$224,102.17</b>

The following statement will show the original cost of the Water Works, with the Extension added from year to year, to November 30, 1871.

Cost of the Works in . . . . .	1865 . . . . .	\$291,480.00
Expended in extension, balance 1865 . . . . .		3,408.91
" " " . . . . .	1866 . . . . .	88,185.74
" " " . . . . .	1867 . . . . .	188,625.06
" " " . . . . .	1868 . . . . .	160,496.38
" " " . . . . .	1869 . . . . .	99,313.51
" " " . . . . .	1870 . . . . .	56,906.46
" " " . . . . .	1871 . . . . .	56,730.39
Total cost Nov. 30, 1871 . . . . .		<b>\$945,146.45</b>

We now present sundry statements showing in brief all other transactions besides the cost and extension account, on account of the Water Works each year since their purchase, with the annual gain.

## 1865.

## RECEIVED.

Water rates . . . . .	\$32,367.19	
Supply account . . . . .	3,826.34	
Sundries . . . . .	1,411.95	
	<hr/>	\$37,605.48

## EXPENDED.

Care and repairs . . . . .	\$7,196.58	
Supply account . . . . .	5,230.45	
Interest . . . . .	7,062.79	
	<hr/>	19,489.82

Balance, showing gain in 1865, 

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 \$18,115.66

## 1866.

## RECEIVED.

Water rates . . . . .	\$40,073.27	
Supply account . . . . .	10,883.30	
Interest . . . . .	442.05	
	<hr/>	\$51,398.62

## EXPENDED.

Care and repairs . . . . .	\$13,791.00	
Supply account . . . . .	8,878.80	
Interest . . . . .	17,484.00	
	<hr/>	40,153.80

Balance, showing gain in 1866, 

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 \$11,244.82

## 1867.

## RECEIVED.

Water rates . . . . .	\$52,733.62	
Supply account . . . . .	11,647.55	
Sundries . . . . .	1,659.49	
Interest . . . . .	1,609.72	
	<hr/>	\$67,650.38

## EXPENDED.

Care and repairs . . . . .	\$17,813.32	
Supply account . . . . .	9,765.14	
Interest . . . . .	27,984.00	
Discount on bonds . . . . .	1,067.21	
	<hr/>	56,629.67

Balance, showing gain in 1867, 

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 \$11,020.71

## 1868.

## RECEIVED.

Water rates . . . . .	\$63,747.42	
Supply account . . . . .	13,315.43	
Sundries . . . . .	2,371.71	
Interest . . . . .	4,328.81	
	<hr/>	\$83,763.37

## EXPENDED.

Care and repairs . . . . .	\$16,508.85	
Supply account . . . . .	13,461.91	
Interest . . . . .	37,014.00	
Discount on bonds . . . . .	2,809.11	
	<hr/>	69,793.87
Balance, showing gain in 1868,		<hr/> \$13,969.50

## 1869.

## RECEIVED.

Water rates . . . . .	\$76,149.30	
Supply account . . . . .	14,150.23	
Sundries . . . . .	1,048.39	
Interest . . . . .	1,133.84	
	<hr/>	\$92,481.76

## EXPENDED.

Care and repairs . . . . .	\$20,082.91	
Supply account . . . . .	13,465.91	
Interest . . . . .	46,344.00	
	<hr/>	79,892.82
Balance, showing gain in 1869,		<hr/> \$12,588.94

## 1870.

## RECEIVED.

Water rates . . . . .	\$92,606.95	
Supply account . . . . .	16,382.93	
Sundries . . . . .	509.08	
Interest . . . . .	5,793.94	
Land sale . . . . .	6,582.74	
Somerville pipes . . . . .	4,753.01	
	<hr/>	\$126,628.65

Amount brought forward . . . \$126,628.65

## EXPENDED.

Care and repairs . . . \$19,014.43  
 Supply account . . . 14,999.57  
 Interest . . . 49,704.00

83,718.00

Balance, showing gain in 1870, ——— \$42,910.65

1871.

## RECEIVED.

Water rates . . . \$111,782.65  
 Supply account . . . 15,750.85  
 Sundries . . . 539.21  
 Interest . . . 6,029.46

\$134,102.17

## EXPENDED.

Care and repairs . . . \$21,188.67  
 Supply account . . . 15,342.36  
 Interest . . . 53,304.00

89,835.03

Balance, showing gain in 1871, ——— \$44,267.14

As it is a part of our duty to present to the City Council from time to time for their consideration, such things as in our judgment are needed to perfect, so far as may be, the work so well begun, we would call your attention to the following statements and recommendations.

We have just passed through the second successive season of extreme drought, and consequent very low stage of water in Fresh Pond. The fact that we are not properly connected with any of our resources for water except Fresh Pond, has been the cause of some anxiety to the members of the Board. It is not desirable and scarcely endurable that a community of 40,000 persons should run anywhere near a water famine, and we have asked in all seriousness what is best for us to do to prevent the possibility of such an event.

The water in Fresh Pond is so remarkably pure and good, that we think, first of all, every effort should be made to store and husband all we can from this source. Fresh Pond is Cambridge's great natural reservoir. Using the water as we do through a



stand-pipe, we use it in the same condition that it comes from the pond, hence the great importance of giving every attention to the purity of the water in the pond; and in this connection we would call your particular attention to the necessity of cleaning out some portions of the pond at the earliest practicable moment. Although the pipe through which the water is conducted to the pump is carried far out into deep water, the screens are often so obstructed by vegetable matter detached from the shallow borders of the pond as to require much labor to keep them free. By removing the vegetable accumulations from an area estimated to cover about seventeen acres, the pond will become comparatively purified, and at the same time the storage capacity considerably increased. There should be no delay in attending to this matter.

The act under which we take the water does not allow us to raise the water above "high-water mark." The only objection that we can see to raising it higher, if we can thereby retain the water, is in regard to the fish running in from Alewife Brook, but as the fisheries are now of comparatively little value, we think this objection might be overruled in our favor if the subject were properly represented to the Legislature.

If we could hold the water three feet above high-water mark, it would give us about 195,000,000 gallons more in the pond, and increase our supply from this source by just that amount.

In our last Annual Report we presented a detailed statement, purporting to show the estimated capacity of our present water supply, comprising Fresh, Little, Spy Ponds, etc., but more particularly showing the supposed capacity of Fresh Pond to furnish a large amount of water from some unseen source.

We find by reëxamination of our statement of last year, and comparison with a Report made by the President of the old Water Company in 1857, which was the basis upon which our statement was made up, that by a misunderstanding of the figures therein we fell into an error, which in the results reached by us led us far astray in regard to the amount of water supposed to be furnished by Fresh Pond from unseen sources.

After correcting this error we find that instead of rating the measurement of the pond at 3,000,000 gallons per inch at low-water mark, it should be 5,000,000 per inch.

We have not seen anything in the principles upon which the calculations were made that was wrong, but careful scrutiny has confirmed us in their substantial correctness.

We now present to you a statement made on the same principles as last year, reckoning 5,000,000 gallons to one inch in the pond, and 320 gallons per revolution of the pumping engine; and with the following as the basis of our calculations:—

*First.* We cover the time from July 2 to November 21, in 1870 and 1871.

*Second.* The water-shed of Fresh Pond is estimated at 1,200 acres.

*Third.* The area of the pond in making up the amount of rain-fall is estimated at 200 acres.

*Fourth.* The evaporation from the surface of the pond will be equal to the rain-fall on its surface, leaving us 1,000 acres to gather rain-fall from.

*Fifth.* It is allowed that four tenths of the rain-fall outside the pond finds its way into the pond.

*Sixth.* In estimating the amount of water the pond will furnish per inch, we call the surface 185 acres, which is about its low-water area; 200 acres being its high-water area.

#### 1870.

Rain-fall July 2 to November 21, 1870, was 9.91 inches; 9.91 inches on 1,000 acres equals 19.82 on 200 acres at  $\frac{1}{10}$ .

Gain in pond by rain-fall, 19.82 inches . . . . .	99,100,000
Fall in pond in same time 30.40 inches . . . . .	152,000,000
Making total supply from this source . . . . .	251,100,000
Amount pumped during same time . . . . .	268,752,292
Difference . . . . .	17,652,292

Showing that we pumped 17,652.292 gallons more than is accounted for above; but as this amount only represents about  $3\frac{1}{2}$  inches on the pond, we think that, as when we began to pump, July 2, the pond was  $30\frac{1}{2}$  inches higher than on November 21, when we left off, all this can be accounted for by the larger area of the pond at that time.



## 1871.

Rain fall July 2d to November 21, 1871, was 15.72 inches. 15.72 inches on 1,000 acres equals 31.44 on 200 acres at  $\frac{1}{8}$ .

Gain in pond by rain-fall, 31.44 inches . . . .	157,200,000
Fall in pond in same time, 15.75 inches . . . .	78,750,000
Making total supply from this source . . . .	235,950,000
Amount pumped during same time . . . . .	236,313,200
Difference . . . . .	363,200

These statements, made up, as we believe, on a correct basis, and confirming each other as they do, would seem to show almost conclusively that so far as we have pumped from the pond, there is no evidence that there is any unseen source of water supply connected with it; and that the belief of some to the contrary, which belief our calculations of last year seemed to prove, is really without any tangible basis to rest upon.

We would here state that from recent observations it appears that we do not pump as much as three hundred and twenty gallons per revolution, in which case it would be shown that the pond has not furnished as much water as is claimed by the rain-fall in these calculations. On the other hand, we have been informed that observations have been made at the pond in the winter, when, in addition to our pumping, large quantities of ice were removed daily, and no corresponding fall in the pond was noticed. We propose, during the coming year, to make such observations and experiments in regard to these matters as will enable us to present the whole subject to you in a more intelligible and reliable manner.

The result so far, we think, shows that we ought not to depend upon getting from Fresh Pond any more water than the natural deposit from rain-fall, and increases the necessity of our retaining all we can of that means of supply.

Our next sources of supply are Little and Spy Ponds. The water in these ponds, in certain seasons of the year, and when it is most needed for use, passes through a process of fermentation, which at that time makes it unsuitable for domestic use without filtering; still, during nine or ten months of the year the water is sweet and good. We think a pipe should be laid at

once connecting the three ponds, so that the water in the other ponds can be used when it is good, to reinforce Fresh Pond ; and when it is bad, can be shut out by a gate in the pipe.

We find there are other small sources of water supply in Middlesex County, which might be of great use to us if we could secure them. In view of the foregoing, and also to provide for the prospective wants of our rapidly growing city, we recommend the City Council to make application to the Legislature as follows : —

*First.* For leave to raise the ponds above high-water mark, and shut out the fish.

*Second.* That we be permitted to take the water from such streams in this county (the right of which is not already granted to others) as we can bring to advantage to reinforce our present water supply.

*Thurd.* That we be permitted to increase the amount of Water Bonds, for the extension of the Water Works to \$1,500,000.

During the past year great efforts have been made by our Superintendent, as well as by special examinations, to detect leaks in the pipes, and prevent unnecessary waste of water. The fact that while there has been a considerable increase in the number of water takers during the past year, the amount of water pumped has not increased, is proof that the labor has not been in vain. It is, however, our conviction that we have reached the minimum amount of water to supply the city, and that we must provide for a constantly increasing demand in the future.

This Board are of the opinion that the "Sinking Fund" does not show in accordance with the law in reference to the same, and we would recommend that the City Council appoint a committee to examine the same ; and suggest that the committee consist of the City Treasurer, the City Auditor, with any others that the Water Board may appoint from their number for this purpose.

We would also respectfully recommend the City Council so to amend the Water Ordinance, that the Sinking Fund of the Water Works may be made up to November 30th each year, at the same time that all other city accounts are made up ; and also to change the time for collecting the water rates from July to Jan-

uary, after which the Sinking Fund will show as nearly as practicable the actual standing of the Water Works at the end of each year.

It has been the rule of the Board to lay main pipes in the streets of the city wherever the water rates subscribed would warrant an income to pay interest on the outlay. Under this rule, about seven miles per year have been laid in each of the three last years. The total length of main pipe in the city is now about sixty-seven miles, and there remain about fifteen miles yet to be piped. The whole subject of piping the streets is in the hands of a committee, and early in the next year we propose to present to the City Council an estimate for this purpose for the ensuing year.

The Board have contracted with Mr. H. R. Worthington, of New York City, for the construction of a new duplex pumping engine of the best construction, the same to be finished and set up in working order by the 1st of September, 1872.

In closing our Report, we wish to refer to a matter that does not come under our especial charge, — a plan by which we think the condition of the pond might be greatly improved. We mean the construction of a road around the borders of our beautiful lake.

There is a constantly increasing demand upon us to provide for the drainage from the estates bordering on the pond, which now pollutes the water. The construction of a sewer in connection with such a road, would carry all the drainage into Alewife Brook, below the outlet of the pond. This, with the clearing up of the banks between such a road and the borders of the pond, would do much towards keeping the water clean and pure. The parties who own the land abutting on the pond, are largely engaged in cutting and storing ice, and it is for their interest to increase the purity of the water and the area of the pond by clearing out the vegetable matter therein. We have reason to believe they would join in this great improvement.

The greatly enhanced value of the four or five hundred acres of land that would thus be rendered a most attractive locality for building purposes, would make it an object alike to the city, the town of Belmont, and the land-owners, to spend the money

required for this purpose, aside from the benefit it would be to our natural reservoir.

All which is respectfully submitted,

J. WARREN MERRILL,  
H. R. HARDING,  
JOSEPH H. CONVERSE,  
GEORGE P. CARTER,  
HENRY L. EUSTIS,  
CHESTER W. KINGSLEY,  
SAMUEL SLOCOMB,

} *Cambridge  
Water Board.*

*December 13, 1871.*

# REPORT

OF

## THE WATER REGISTRAR.

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WATER REGISTRAR'S OFFICE,  
CAMBRIDGE, December 1, 1871. }

*To the Cambridge Water Board:—*

GENTLEMEN, — In accordance with the provisions of the ordinance for the care and management of the Cambridge Water Works, I hereby respectfully submit my report for the year ending November 30, 1871.

### Receipts.

Water rates . . . . .	\$111,782.65
Supply account for service pipe, laying, repairing, shutting off and letting on water . . . . .	15,750 85
Total cash receipts from all sources . . . . .	\$127,533.50
All of which has been paid into the City Treasury.	
The increased amount of income for the financial year, over the previous year, is . . . . .	\$18,034.54

### Expenditures.

The expenditures for the care and management of the Works for the year ending November 30, 1871, have been as follows:—

For care and repairs . . . . .	\$8,247.00
For pumping service . . . . .	8,819.88
For office expenses . . . . .	4,121.79
Total amount . . . . .	\$21,188.67
The expenditures on the extension of the Works for the year ending Nov. 30, 1871, were . . .	
The expenditure on supply account was . . . . .	15,342.36



## Supply Account.

Cash received on above account . . .	\$15,750.85	
Now due . . . . .	9,989.76	
		\$25,740.61
There was reported due Dec. 1, 1870 . .	\$8,511.49	
Since expended . . . . .	15,342.36	
		<u>23,853.85</u>
Balance in favor of account . . . . .		\$1,886.76

During the year the water has been turned off for non-payment of rates one hundred and fifty-nine times. Of this number one hundred and fifty-three have been let on, leaving a balance of six still remaining off.

The following table exhibits the yearly revenue received from the sale of Fresh Pond water since the purchase of the Works by the city: —

From April 28, 1865, to Dec. 1, 1865 . . . . .	\$32,367.19
“ Dec. 1, 1865, “ 1866 . . . . .	40,073.27
“ “ 1866, “ 1867 . . . . .	52,733.62
“ “ 1867, “ 1868 . . . . .	63,747.42
“ “ 1868, “ 1869 . . . . .	76,149.30
“ “ 1869, “ 1870 . . . . .	92,606.95
“ “ 1870, “ 1871 . . . . .	111,782.65
	<u>\$469,460.40</u>

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, ETC.,  
SUPPLIED WITH FRESH POND WATER, DECEMBER 1, 1871.

7,151 Families.
693 Hand Hose.
491 Private Stables.
189 Stores.
75 Stationary Engines.
39 Offices.
32 Boarding-houses.
32 Saloons.

- 28 Reservoirs.
- 28 Barber Shops.
- 26 Meat Markets.
- 22 School-houses.
- 18 Soap Manufactories.
- 16 Bake-houses.
- 15 Blacksmith Shops.
- 13 Fish Markets.
- 13 College Buildings.
- 12 Greenhouses.
- 12 Livery Stables.
- 11 Public Halls.
- 10 Furniture Manufactories.
- 10 Cow Pastures.
- 9 Churches.
- 9 Machine Shops.
- 9 Printing Offices.
- 8 Lumber Wharves.
- 7 Coal Wharves.
- 6 Banks.
- 6 Public Houses.
- 6 Billiard Halls.
- 6 Horse Railroad Stables.
- 5 Club Rooms.
- 5 Stone Yards.
- 5 Photograph Rooms.
- 4 Book Binderies.
- 4 Glass Works.
- 4 Fire Engine-houses.
- 4 Police Stations.
- 4 Planing Mills.
- 4 Cigar Manufactories.
- 4 Post Offices.
- 4 Slaughter-houses.
- 4 Iron Foundries.
- 4 Carriage Manufactories.
- 3 Cooper Shops.
- 3 Nurseries.
- 2 Brush Manufactories.



- 2 Box Manufactories.
- 2 Tinware Manufactories.
- 2 Organ Manufactories.
- 2 Chemical Works.
- 2 Cattle Yards.
- 2 Club Stables.
- 2 Libraries.
- 2 Steam Railroad Depots.
- 2 Marble Works.
- 2 Bacon Works.
- 2 Stereotype Foundries.
- 2 Tallow Factories.
- 2 Private Schools.
- 2 I. O. of O. F. Halls.
- 2 Masonic Halls.
- 2 City Stables.
- 1 Alms-house.
- 1 Brass Foundry.
- 1 Brewery.
- 1 Boiler Manufactory.
- 1 Botanic Garden.
- 1 Brick Yard.
- 1 Currier Shop.
- 1 Color Manufactory.
- 1 Coffin Manufactory.
- 1 City Hall.
- 1 City Wharf.
- 1 Confectionery Manufactory.
- 1 Cemetery.
- 1 Drain Pipe Manufactory.
- 1 Distillery.
- 1 G. A. R. Hall.
- 1 Gas Works.
- 1 Gymnasium.
- 1 House of Correction.
- 1 Laundry.
- 1 Lead Pipe Works.
- 1 Lard Works.
- 1 Museum of Comparative Zoölogy.

- 1 Oil Factory.
- 1 Paper Collar Manufactory.
- 1 Poultry House.
- 1 Rolling Mill.
- 1 Riding School.
- 1 Steam Railroad.
- 1 State Arsenal.
- 1 Sausage Manufactory.
- 1 Sugar Refinery.
- 1 Swine Yard.
- 1 Vinegar Factory.

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### STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE  
PREMISES OF WATER TAKERS IN THE CITY OF CAMBRIDGE,  
DECEMBER 1, 1871.

- 8,222 Faucets.
- 1,810 Wash Bowls.
- 1,586 Water Closets.
- 1,038 Bath Tubs.
- 811 Wash Tubs.
- 300 Fire Hydrants.
- 188 Slop Closets.
- 11 Public Drinking Fountains.
- 10 Private Fountains.

The total number of meters now in use is 81. They are attached to a variety of establishments, as follows:—

WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{1}{8}$ inch.	$\frac{3}{8}$ inch.	1 inch.	$1\frac{1}{2}$ inch.	2 inch.	3 inch.	4 inch.
Bay State Glass Co. . . . .	-	-	-	-	1	-	-
Boston and Lowell Railroad Co. . . . .	-	-	1	-	3	-	1
Badger & Batchelder . . . . .	-	-	-	1	-	-	-
Braman, Shaw, & Co. . . . .	-	-	-	1	-	-	-
Boston Chemical Works . . . . .	-	-	-	-	1	-	-
Beal & Hooper . . . . .	-	-	-	-	1	-	-
Boston Silver Glass Co. . . . .	-	-	-	-	1	-	-
Boston Rolling Mill . . . . .	-	-	-	-	1	-	-
B. P. Clark & Co. . . . .	-	-	1	-	-	-	-
Brazier & Whittemore . . . . .	-	-	2	-	-	-	-
Boston Stamping and Manufacturing Co. . . . .	-	-	1	-	-	-	-
Boston Car Wheel Co. . . . .	-	1	-	-	-	-	-
Bay State Color Co. . . . .	-	-	-	-	1	-	-
C. L. Jones . . . . .	-	-	1	-	-	-	-
Cambridge Gas Light Co. . . . .	-	-	-	-	-	1	-
Curtis Davis . . . . .	-	-	-	1	-	-	-
Cambridge Stamping Co. . . . .	1	1	-	-	-	-	-
Doe & Hunnewell . . . . .	-	-	-	1	-	-	-
Day & Collins . . . . .	-	-	1	-	-	-	-
Francis Draper & Co. . . . .	-	1	-	-	-	-	-
F. Geldowsky . . . . .	-	-	-	1	-	-	-
George G. Page & Co. . . . .	-	-	1	-	-	-	-
George Woods & Co. . . . .	-	-	-	1	-	-	-
House of Correction . . . . .	-	-	-	-	1	-	-
H. O. Houghton & Co. . . . .	-	-	1	-	-	-	-
Henry Thayer & Co. . . . .	-	-	-	-	1	-	-
Hancock & Greely . . . . .	-	1	-	-	-	-	-
H. M. Clark . . . . .	-	1	-	-	-	-	-
Holyoke House . . . . .	-	-	-	-	1	-	-
John K. Hodgdon . . . . .	-	-	-	-	1	-	-
James McIntosh . . . . .	-	-	1	-	-	-	-
John P. Squire & Co. . . . .	-	1	-	-	1	-	-
John Wilson & Co. . . . .	-	-	1	-	-	-	-
John Reardon & Sons . . . . .	-	-	1	-	-	-	-
J. J. Gray . . . . .	-	-	1	-	-	-	-
James C. Davis . . . . .	-	-	1	-	-	-	-
James B. Kent . . . . .	-	-	1	-	-	-	-
Joseph Boynton . . . . .	1	-	-	-	-	-	-
James Lee . . . . .	-	-	1	-	-	-	-
Leonard Cox . . . . .	-	1	-	-	-	-	-
Little & Brown . . . . .	-	-	1	-	-	-	-
Lyman Kinsley & Co. . . . .	-	-	-	-	1	-	-
Mt. Auburn Cemetery . . . . .	-	-	-	1	1	-	-
Mason & Hamlin . . . . .	-	-	1	-	-	-	-
North, Meriam, & Co. . . . .	-	-	-	-	1	-	-
New England Glass Co. . . . .	-	-	-	-	1	-	-
O. S. Bullock . . . . .	-	-	1	-	-	-	-
Prospect House . . . . .	-	-	-	1	-	-	-
Revere Sugar Refinery . . . . .	-	-	-	-	1	-	-
Reversible Collar Co. . . . .	-	-	-	-	1	-	-
Shawmut Iron Works . . . . .	-	1	-	-	-	-	-
Sylvester Tower . . . . .	-	-	1	-	-	-	-
S. M. Cofran . . . . .	-	-	-	-	1	-	-
St. Mary's Church . . . . .	-	-	-	-	1	-	-
Thayer Club . . . . .	-	1	-	-	-	-	-
T. S. Huckins . . . . .	-	-	1	-	-	-	-

WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{1}{4}$ inch.	$\frac{3}{8}$ inch.	1 inch.	$1\frac{1}{2}$ inch.	2 inch.	3 inch.	4 inch.
Theodore Downing . . . . .	—	—	1	—	—	—	—
Union Glass Co. . . . .	—	1	2	—	—	—	—
Union Railway Co. . . . .	—	6	2	2	—	—	—
Woodbury & Co. . . . .	—	—	—	—	1	—	—
Welch, Bigelow, & Co. . . . .	—	1	—	—	—	—	—
Asa Gray . . . . .	—	—	—	1	—	—	—

As required by the ordinance, every building supplied with Fresh Pond water has been visited.

Respectfully submitted,

A. F. FIFIELD,

*Water Registrar.*

**REPORT**  
**CONCERNING**  
**THE ACCOUNTS OF THE WATER REGISTRAR.**

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IN CAMBRIDGE WATER BOARD, }  
*December 13, 1871.* }

THE Committee appointed to examine the accounts of the Water Registrar for the financial year ending November 30, 1871, herewith submit the following

**REPORT:**

Your Committee have examined the books and accounts of the Water Registrar, and compared them with the vouchers, and find that the same are correct in all respects.

Respectfully submitted,

S. SLOCOMB,  
GEORGE P. CARTER, } *Committee.*

# REPORT

OF THE

## SUPERINTENDENT OF THE WATER WORKS.

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*To the Water Board of the City of Cambridge : —*

GENTLEMEN, — Having assumed again the duties to which you appointed me, and in conformity with the requirements of the City Ordinance relating to the Water Works, I hereby submit for your consideration the Seventh Annual Report of the condition of the Works under my charge, together with a detailed statement of the work performed under my direction for the year ending November 30, 1871.

### Pond.

In December, 1870, the brook between Spy and Fresh Ponds was thoroughly cleaned out and the flash boards were raised daily to allow the fish to leave the pond. In January, there was a continual flow of water between the two ponds, and the water in Fresh Pond was eight inches above the lowest point of 1870. In February, the water was  $11\frac{1}{2}$  inches above the lowest point of 1870. In March, the lower flash boards at the outlet of the two ponds were removed, and the brook, with the upper gates, was placed in charge of the fish officer to meet the requirements of the law. During the month the water in the pond was 33 inches above the lowest point of 1870. In May, 32 inches, and in June 24 inches above the lowest point of 1870. During this month the gate was kept closed in consequence of the high water on the meadows. In July, the water was  $14\frac{1}{2}$  inches; in August, 10 inches; in September, 4 inches; in October, 5 inches; and in November 8 inches above the lowest point of 1870, — the latter being 4 feet and 3 inches below the high-water mark as established by the City Engineer. In January, by the direction of

the Board, the 20-inch pipe which formerly conveyed the water from the pond to the old well room was removed, and was sold on the ground to J. J. Walworth & Co. for \$539.21, which amount has been paid to the City Treasurer, and carried to the Sinking Fund.

#### Engine House.

In December, 1870, 160 loads of stone chips were carted from the Almshouse ledge, and were used in ballasting the bank wall around the engine buildings. The only repairs made upon the old pumps during the year were in February, prior to the laying off of the new pumping engine for repairs, when they were overhauled and repaired at a cost for material of \$190.47. On the 8th of March the repairs were made on the new pumping engine by the builder, Mr. H. R. Worthington, at his expense, occupying ten days; the steam jackets, both of which were leaking badly, were patched and made perfectly tight, and the engine has since been on daily duty, working well. In July, a car track was laid from the coal shed to the boiler room, and a hand car has since been used for getting in coal, making quite a material saving in labor. The dwelling-house, which has been vacant more than a year, has been put in repair, and is now occupied by the Engineer. We have at the present time nearly a year's supply of coal on hand. There were 637,912,150 gallons of water pumped the past year, using 1,402,390 pounds of coal. The average number of gallons pumped daily was 1,747,704,—an average daily increase over the previous year of 7,835 gallons,—about 43 gallons daily average for each inhabitant of the city.

#### Force Main.

The force main has been in good order. Only two slight leaks at the joints have occurred in it during the year.

#### Reservoirs.

The reservoirs are both in a very satisfactory condition, and no repairs of any importance have been made on them during the year. In July, the stand pipe was raised fifteen feet.

The following elevations above the marsh level have been obtained from the City Engineer:—



Top of stand pipe . . . . .	122.70 feet.
Overflow in stand pipe . . . . .	120.00 "
Reservoir capping . . . . .	77.00 "
Intersection of Otis and Fourth Streets . . . . .	37.31 "
Harvard Street, near Dana Street . . . . .	45.15 "
Highest land in Cambridge . . . . .	76.71 "
Concord Avenue, near Sparks Street . . . . .	57.16 "
Highest water known in Fresh Pond . . . . .	1.86 "

#### Distribution Pipes.

The total length of pipe in the city is now about sixty-seven miles, and it is in a more satisfactory condition than at any time since the Works were purchased by the city. One hundred and eighty-eight leaks have occurred in pipes as follows: One hundred and ten in joints; eighteen in drive-cocks; fourteen in defective pipes; eight in cement pipes; eight in gates; seven in broken pipes; seven in sleeves; six in hydrants; five in plugs in end of pipe; two in aqueduct logs; one in blow-off; one struck with pick; one in stop-cock in main.

In addition to the new lines of distribution pipes laid the present year, pipes have been removed in several streets, and larger ones laid in their places either because the corrosion of the old pipes had rendered the supply unfit for use, or the smallness of the pipes rendered the supply insufficient for manufacturing purposes and for fire hydrants. Small lines of pipes have also been removed in some streets where larger ones have been laid within a few years, and all the supply pipes on these have been changed. The aqueduct log in Broadway, from Hampshire to Court Street, has been discontinued, and the service pipe attached to the 20-inch main. The 3-inch pipe in Broadway, from Pioneer to Court Street, and the 3-inch pipe in the same street, running 250 feet east and 150 feet west from Davis Street, thus forming two dead ends, has been removed, and all the service pipes connected therewith changed; removing these lines of pipe leaves only the 20-inch main in Broadway east of Winsor Street. In Tremont Street, where we had a line of 4-inch pipe, two hundred and fifty feet of 3-inch pipe have been taken up. Pipes have been removed and larger ones laid as follows:—

Prison Point Street, nine hundred and thirty-four feet of 4-inch pipe taken up, and a 6-inch pipe laid in its place.

Fayette Street, one hundred and thirty-four feet of 3-inch pipe taken up, and a 4-inch pipe laid in its place.

Otis Street, from Third to First Street, eight hundred and twenty-five feet of 4-inch pipe taken up, and a 6-inch pipe laid in its place.

Broadway and Main Street, east of Court Street to Shawmut Iron Works, all the 4 and 3-inch pipes have been taken up and 1,485 feet of 8-inch pipe laid in their place, also one hundred and twenty-six feet of 4-inch pipe in Main Street, west of the junction of Broadway, have been taken up, and a 6-inch pipe laid in its place, thus forming a continuous line of 6-inch pipe in Main Street.

Kirkland Street, from junction of Cambridge Street and Broadway to Baldwin Street, all the 4 and 3-inch pipe has been taken up, and 2,602 feet of 10-inch pipe laid in its place.

In the aggregate, about a lineal mile of pipe.

#### Gates.

All the gates have been examined, and are believed to be in good working order. There have been added seventy-three new gates during the year. Quite a large number of these have been placed on old lines of pipe, to divide the distance, which is not only a great benefit to the Works, but a great convenience to the takers, as formerly it was necessary in repairing leaks and connecting new lines of pipes to shut off large sections of the city. Seventy one gate and hydrant boxes have been raised or lowered to conform to the new grades of streets, and ten decayed boxes have been taken out and replaced by new ones.

#### Hydrants.

The hydrants are all in good order throughout the city. Sixty have been added during the year: a large number of these have been placed on old lines of pipe where there was an evident necessity of having them much nearer together on account of the great increase of buildings during the past two years. Twelve hydrants have been raised entire, twelve hydrant boxes have been taken out and replaced by new ones, and nine have been moved on account of widening streets.

### Meters.

Eighteen meters have been applied to the premises of water takers, and five have been removed where parties have discontinued the use of the water, or the rates received were less than prescribed by the ordinance, making the total number now in use eighty-one. Of this number, two are  $\frac{1}{8}$ -inch; seventeen,  $\frac{1}{4}$ -inch; twenty-seven, 1-inch; eleven,  $1\frac{1}{2}$ -inch; twenty-two, 2-inch; one, 3-inch; and one, 4-inch size.

### Drinking Fountains.

One drinking fountain has been placed at the junction of Broadway and Hampshire Street, making the total number eleven. They have been in constant use eight months of the year, and are a great convenience to the public generally.

### STATEMENT OF SERVICE PIPE LAID IN 1871.

Diameter in inches	Number of Pipes.	Length in Feet.	TOTALS.	
			Number of Pipes	Length in Feet.
3	1	21	1	21
2	6	91	6	91
$1\frac{1}{2}$	2	108	2	108
$1\frac{1}{4}$	19	376	19	376
1	60	3,222	60	3,222
$\frac{3}{4}$	615	35,741	615	35,741
Aggregate			703	39,559
The total number of supply pipes is				4,894

There have been stopped one hundred and six leaks in service pipe, twenty-five in faucets, fifteen in stop and waste cocks, four in yard hydrants, and three in meters.

STATEMENT OF LOCATION, SIZE, AND NUMBER OF FEET OF  
PIPE LAID IN 1871.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Acorn . . . . .	4	211
Allston . . . . .	4	658
Allston . . . . .	3	169
Antrim . . . . .	6	160
Baldwin . . . . .	6	281
Baldwin . . . . .	4	786
Baldwin Court . . . . .	1½	190
Baldwin Court . . . . .	1½	140
Banks . . . . .	6	275
Banks . . . . .	4	221
Bay . . . . .	4	213
Beaver . . . . .	4	200
Beech . . . . .	6	47
Bell Court . . . . .	4	250
Bigelow . . . . .	6	378
Bolton . . . . .	4	226
Brattle . . . . .	4	54
Broadway . . . . .	8	325
Brookline . . . . .	4	220
Buckingham . . . . .	4	216
Cedar . . . . .	6	631
Chestnut . . . . .	4	100
Clark . . . . .	4	634
Cogswell . . . . .	3	521
Cottage . . . . .	4	110
Crane . . . . .	4	42
Dinsmore Place . . . . .	1½	191
Dover . . . . .	4	228
Dyke . . . . .	4	231
Fayette . . . . .	4	1,344
First . . . . .	6	250
Flagg . . . . .	4	189
Flagg Street Court . . . . .	3	168
Fourth . . . . .	4	160
Francis Place . . . . .	4	496
Garden . . . . .	6	928
Garden Court . . . . .	4	455
Gore . . . . .	4	187
Green . . . . .	4	523
Hancock . . . . .	4	500
Harrison Avenue . . . . .	4	102
Harrison Place . . . . .	3	100
Harvey . . . . .	6	710

## STATEMENT OF LOCATION, SIZE, Etc. (continued).

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Henderson Court . . . . .	3	275
Highland Avenue . . . . .	6	418
Highland Avenue . . . . .	4	25
Holly Avenue . . . . .	4	306
Houghton . . . . .	6	36
Hunting . . . . .	6	700
Hunting . . . . .	4	6
Kinnaird . . . . .	4	404
Kirkland . . . . .	10	2,602
Kirkland . . . . .	4	100
Kirkland Place . . . . .	4	540
Lake View Avenue . . . . .	6	1,120
Langdon . . . . .	4	357
Lowell . . . . .	4	54
Lowell Railroad Company . . . . .	6	918
Lowland Avenue . . . . .	4	250
Main . . . . .	8	1,160
Main . . . . .	6	126
Milk . . . . .	6	450
Montgomery . . . . .	4	140
Mount Auburn . . . . .	4	67
Murdock . . . . .	4	60
Ninth . . . . .	6	65
Norfolk . . . . .	4	50
Norris . . . . .	4	281
Norton . . . . .	4	85
North Avenue . . . . .	6	871
North Avenue . . . . .	4	25
Orchard . . . . .	6	330
Otis . . . . .	6	825
Paper . . . . .	6	318
Pearl . . . . .	4	296
Pine . . . . .	4	85
Prison Point . . . . .	6	930
Putnam . . . . .	4	428
Putnam Place . . . . .	4	108
Reed . . . . .	4	48
Reed . . . . .	6	456
Rice . . . . .	4	540
Rideout . . . . .	4	415
South (Somerville) . . . . .	4	184
Spruce . . . . .	12	2,210
Sumner . . . . .	4	230
Sidney . . . . .	3	118
Sidney . . . . .	4	312

## STATEMENT OF LOCATION, SIZE, ETC. (continued).

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Tremont . . . . .	4	720
Vine . . . . .	4	250
Walden . . . . .	6	560
Wallace . . . . .	4	85
Walnut . . . . .	6	880
Walnut Avenue . . . . .	4	80
Washington Avenue . . . . .	6	236
Waverly . . . . .	4	280
Westcott Court . . . . .	3	174
Willow . . . . .	4	44
Willow (Somerville) . . . . .	4	213
Willow Place . . . . .	4	156
Woodbury's Court . . . . .	4	118
Wright . . . . .	4	300

## GATES.

IN WHAT STREET.	Number.	Diameter in Inches.
Allston . . . . .	1	4
Avon . . . . .	1	4
Baldwin . . . . .	1	6
Baldwin . . . . .	1	4
Banks . . . . .	1	6
Bay . . . . .	1	4
Broadway . . . . .	1	8
Brookline . . . . .	1	4
Cambridge . . . . .	2	10
Cedar . . . . .	1	6
Clark . . . . .	3	4
Cogswell . . . . .	1	3
Fayette . . . . .	1	4
First . . . . .	1	6
Flagg . . . . .	1	4
Flagg Street Court . . . . .	1	3
Fourth . . . . .	1	4
Francis Place . . . . .	1	4
Garden . . . . .	2	6
Garden Court . . . . .	1	4
Green . . . . .	1	4
Hancock . . . . .	2	4
Harrison Avenue . . . . .	1	4
Harvey . . . . .	1	6
Henderson Court . . . . .	1	3

## GATES (continued).

IN WHAT STREET.	Number.	Diameter in Inches.
Highland Avenue . . . . .	1	6
Holly Avenue . . . . .	1	4
Hunting . . . . .	1	6
Kirkland . . . . .	2	10
Kirkland Place . . . . .	1	4
Lake View Avenue . . . . .	1	6
Langdon . . . . .	1	4
Lowell Railroad Company . . . . .	1	6
Lowland Avenue . . . . .	1	4
Main . . . . .	1	8
Main . . . . .	1	6
Milk . . . . .	1	6
Montgomery . . . . .	1	3
Norris . . . . .	1	4
North Avenue . . . . .	1	4
North Avenue . . . . .	1	6
Norton . . . . .	1	4
Otis . . . . .	2	6
Otis . . . . .	1	4
Pearl . . . . .	1	4
Prison Point . . . . .	2	6
Prison Point . . . . .	1	4
Prison Point . . . . .	1	3
Reed . . . . .	1	6
Rice . . . . .	1	4
Rideout . . . . .	1	4
South . . . . .	1	4
Spruce . . . . .	2	12
Sumner . . . . .	1	4
Sidney . . . . .	1	4
Tremont . . . . .	2	4
Vine . . . . .	1	4
Walden . . . . .	1	6
Walnut . . . . .	1	6
Ware . . . . .	1	3
Washington . . . . .	1	4
Westacott Court . . . . .	1	4
Willow . . . . .	1	4



## BLOW-OFF PIPES.

IN WHAT STREET.	Number.	Diameter in Inches.
Allston . . . . .	1	1½
Banks . . . . .	1	1½
Bell Court . . . . .	1	1½
Cogswell . . . . .	1	1½
Cottage . . . . .	1	1½
Flagg . . . . .	1	1½
Flagg Street Court . . . . .	1	1½
Francis Place . . . . .	1	1½
Garden . . . . .	2	1½
Garden Court . . . . .	2	1½
Green . . . . .	2	1½
Harrison Avenue . . . . .	1	1½
Harrison Place . . . . .	1	1½
Henderson Court . . . . .	1	1½
Holly Avenue . . . . .	1	1½
Kinnaird . . . . .	2	1½
Lake View Avenue . . . . .	1	1½
Norris . . . . .	1	1½
Pearl . . . . .	1	1½
Sidney . . . . .	1	1½
Walden . . . . .	1	1½
Westacott Court . . . . .	1	1½
Willow . . . . .	1	1½
Wright . . . . .	1	1½

## RECAPITULATION.

2,210 feet . . . . .	12-inch pipe.
2,602 feet . . . . .	10-inch pipe.
1,485 feet . . . . .	8-inch pipe.
12,207 feet . . . . .	6-inch pipe.
16,198 feet . . . . .	4-inch pipe.
1,525 feet . . . . .	3-inch pipe.
331 feet . . . . .	1½-inch pipe.
190 feet . . . . .	1¼-inch pipe.

## Gates.

2 . . . . .	12-inch.
4 . . . . .	10-inch.
2 . . . . .	8-inch.
21 . . . . .	6-inch.
38 . . . . .	4-inch.
6 . . . . .	3-inch.

## Blow-Off Pipes.

28 . . . . .	1½-inch.
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## STATEMENT

## OF STOCK ON HAND EXCLUSIVE OF TOOLS.

20 feet 24-inch pipe.	3 8-inch sleeves, clamp.
48 feet 20-inch pipe.	4 4-inch sleeves, clamp.
36 feet 16-inch pipe.	11 8 × 4-inch T's.
300 feet 12-inch pipe.	14 6 × 6-inch T's.
840 feet 10-inch pipe.	4 6 × 4-inch T's.
2,500 feet 8-inch pipe.	14 4 × 4-inch T's.
1,700 feet 6-inch pipe.	6 3 × 3-inch T's.
1,800 feet 4-inch pipe.	1 20 × 6-inch cross.
1 24-inch gate.	7 12 × 6-inch crosses.
1 20-inch gate.	1 8 × 6-inch cross.
1 16-inch gate.	10 8 × 4-inch crosses.
1 12-inch gate.	17 6 × 6-inch crosses.
4 8-inch gates.	14 4 × 4-inch crosses.
3 6-inch gates.	4 12 to 6-inch reducers.
3 3-inch gates.	6 10 to 6-inch reducers.
3 20-inch sleeves.	5 8 to 6-inch reducers.
1 16-inch sleeve.	10 6 to 4-inch reducers.
5 12-inch sleeves.	11 4 to 3-inch reducers.
2 10-inch sleeves.	11 10-inch ½-bends.
10 8-inch sleeves.	4 8 inch ½-bends.
10 6-inch sleeves.	7 6-inch ½-bends.
35 4-inch sleeves.	6 6-inch offsets.
7 3-inch sleeves.	2 4-inch offsets.
1 24 × 12-inch T.	4 12-inch elbows.
2 20 × 12-inch T's.	4 gate boxes.
1 20 × 10-inch T.	2 gate frames, large.
2 20 × 4-inch T's.	2 gate frames, small.
6 12 × 6-inch T's.	2 hydrant boxes.
2 10 × 10-inch T's.	4 hydrant frames.
2 10 × 6-inch T's.	1,000 feet burnettized plank.
4 10 × 4-inch T's.	300 feet dressed boards.
5 8 × 8-inch T's.	100 loads gravel.
2 24-inch sleeves, clamp.	50 pounds old brass.
3 12-inch sleeves, clamp.	6 tons old iron.
2 10-inch sleeves, clamp.	3 3-inch fire hydrants.

## Meters.

4 2-inch meters.

3 1-inch meters.

4  $1\frac{1}{2}$ -inch meters.8  $\frac{3}{4}$ -inch meters.

## Galvanized Pipe.

150 feet 2-inch galvanized pipe.

125 feet 1-in. galvanized pipe.

250 feet  $1\frac{1}{2}$ -in. galvanized pipe.1,300 feet  $\frac{3}{4}$ -in. galvanized pipe.180 feet  $1\frac{1}{4}$ -in. galvanized pipe.150 feet  $\frac{1}{2}$ -in. galvanized pipe.

## For Service Pipe.

32 2-inch couplings.

250 socket ends.

36  $1\frac{1}{2}$ -inch couplings.

5 garden hydrants.

30  $1\frac{1}{4}$ -inch couplings.

12 2-inch T's.

12 1-inch couplings.

14  $1\frac{1}{2}$ -inch T's.75  $\frac{3}{4}$ -inch couplings.25  $1\frac{1}{4}$ -inch T's.9  $1\frac{1}{2}$ -inch plugs.

50 1-inch T's.

12  $1\frac{1}{4}$ -inch plugs.20  $\frac{3}{4} \times \frac{1}{2}$ -inch T's.

51 1-inch plugs.

100  $\frac{3}{4}$ -inch T's.12  $\frac{3}{4}$ -inch plugs.25  $\frac{1}{2}$ -inch T's.

14 2-inch elbows.

6  $1\frac{1}{2} \times \frac{3}{4}$ -inch crosses.15  $1\frac{1}{2}$ -inch elbows.

25 1-inch crosses.

12  $1\frac{1}{4}$ -inch elbows.100  $\frac{3}{4}$ -inch clips.

15 1-inch elbows.

12  $2 \times 1\frac{1}{2}$ -inch bushings.74  $\frac{3}{4}$ -inch elbows.12  $2 \times 1\frac{1}{4}$ -inch bushings.

18 1-inch street elbows.

12  $2 \times 1$ -inch bushings.18  $\frac{3}{4}$ -inch street elbows.12  $1\frac{1}{2} \times 1\frac{1}{4}$ -inch bushings.

17 2-inch nipples.

12  $1\frac{1}{2} \times \frac{3}{4}$ -inch bushings.15  $1\frac{1}{2}$ -inch nipples.12  $1\frac{1}{4} \times 1$ -inch bushings.11  $1\frac{1}{4}$ -inch nipples.12  $1\frac{1}{4} \times \frac{3}{4}$ -inch bushings.

54 1-inch nipples.

24  $1 \times \frac{3}{4}$ -inch bushings.35  $\frac{3}{4}$ -inch nipples.24  $1 \times \frac{1}{2}$ -inch bushings.

4 2-inch unions.

12 1-inch screw cocks.

7  $1\frac{1}{2}$ -inch unions.6  $\frac{3}{4}$ -inch screw cocks.8  $1\frac{1}{4}$ -inch unions.15  $\frac{3}{4}$ -in. stop and waste cocks.

8 1-inch unions.

12 1-inch air chambers.

7  $\frac{3}{4}$ -inch unions.14  $\frac{3}{4}$ -inch air chambers.

24 1-inch lock nuts.

17  $\frac{1}{2}$ -inch air chambers.10  $\frac{3}{4}$ -inch lock nuts.12  $\frac{3}{4}$ -inch hose bibbs.

12 $\frac{1}{2}$ -inch hose bibbs.	12 $\frac{3}{4}$ -inch solder nipples.
15 $\frac{3}{4}$ -inch drive cocks.	1 barrel cement.
12 $\frac{3}{4}$ -inch garden hydrants.	1 barrel pipe clay.
25 $\frac{3}{4}$ -inch corporation cocks.	

**Tools.**

45 picks.	1 wheelbarrow.
40 shovels.	2 sets caulking tools, complete.
20 rammers.	7 lump hammers.
7 crow bars.	4 pipe cutters.
2 paving hammers.	2 set dies, complete.
4 trowels.	2 scroll plates.
4 saws.	1 cylinder stove.
4 hand axes.	1 thawing boiler.
6 gate wrenches.	2 thawing pumps.
5 hydrant wrenches.	4 furnaces.
6 supply wrenches.	3 ratchets.
4 blow off wrenches.	8 pairs rubber boots.
1 4-inch monkey wrench.	1 pair scales.
2 3-inch monkey wrenches.	200 pounds packing.
4 2-inch monkey wrenches.	1 $\frac{1}{2}$ tons lead.
12 pairs tongs.	12 lanterns.
4 sledge hammers.	1 horse.
1 drilling machine.	2 harnesses.
4 hydrant goose-necks.	3 light wagons.
1 boom derrick, large.	1 heavy wagon.
2 derricks, small.	3 hand-carts.
4 tool chests.	1 pung.
2 bench vises.	1 light sleigh.
2 benches.	1 grindstone.
39 draws for supply fittings.	

**At Pond.**

2 globe lamps.	1 bench vise.
3 hand lamps.	1 hand vise.
3 lanterns.	1 pair pliers.
6 lamp chimneys.	12 files.
12 lamp wicks.	6 file handles.
1 pair lamp shears.	12 sheets emery cloth.

4 screw wrenches.  
 12 iron wrenches.  
 19 socket wrenches.  
 2 gate wrenches.  
 3 die plates.  
 2 sets dies, complete.  
 2 sets taps.  
 2 ratchets.  
 1 breast drill.  
 1 drill brace.  
 22 drills.  
 18 cold chisels.  
 10 caulking tools.  
 2 jack screws.  
 2 steel bars.  
 2 iron bars.  
 1 sledge.  
 1 copper hammer.  
 2 hand hammers.  
 2 coal hammers.  
 1 forge.  
 1 anvil.  
 8 pairs tongs.  
 100 pounds bar iron.  
 15 pairs pipe tongs.  
 50 feet pipe.  
 12 T's.  
 36 elbows.  
 40 nipples.  
 40 couplings.  
 4 union joints.  
 3 globe valves.  
 2 oil cups.  
 1 soldering iron.  
 1 pound solder.  
 30 pounds lead.  
 3 pounds Babbitt's metal.  
 2 ladles.  
 150 pounds bolts and nuts.

5 pounds washers.  
 12 1-inch bolts.  
 18  $\frac{3}{4}$  to 1 $\frac{1}{4}$  inches.  
 9 eye bolts.  
 1 air pump link.  
 1 rotary pump.  
 24 valve springs.  
 4 pounds sheet brass.  
 1 differential block.  
 1 turn buckle.  
 1 carpenter's chest.  
 2 hand planes.  
 3 hand saws.  
 1 axe.  
 1 square.  
 1 drawing knife.  
 2 chisels.  
 8 gouges.  
 3 bit stocks.  
 10 bits.  
 3 screw drivers.  
 1 grindstone.  
 6 pounds screws.  
 50 pounds cut nails.  
 8 pounds white lead.  
 10 pounds brown paint.  
 2 paint brushes.  
 10 oil cans.  
 6 gallons kerosene.  
 $\frac{1}{2}$  gallon lard oil.  
 140 pounds tallow.  
 45 sheets rubber.  
 19 9-inch rubber valves.  
 9 5-inch rubber valves.  
 50 2 $\frac{1}{2}$ -inch rubber valves.  
 4 36-inch rubber gaskets.  
 2 pairs rubber boots.  
 50 pounds jute packing.  
 2 pounds hemp packing.

70 pounds Martin's packing.  
 100 feet rubber hose.  
 10 yards felting.  
 1 set fire tools.  
 3 shovels.  
 1 spade.  
 3 hoes.  
 2 rakes.  
 1 prong hoe.  
 1 weeder.  
 1 pitch fork.  
 1 scythe and snath.  
 1 iron roller.  
 3 water pails.  
 1 sprinkler.  
 3 brooms.  
 1 dust brush.

1 window brush.  
 2 whitewash brushes.  
 2 tube brushes.  
 4 ladders.  
 1 step ladder.  
 1 rat trap.  
 1 steam trap.  
 2 screens.  
 2 scoop nets.  
 2 pairs platform scales.  
 1 coal car.  
 1 wheelbarrow.  
 2 desks.  
 10 chairs.  
 3 spittoons.  
 4 mats.  
 1 set letters.

Respectfully submitted.

S. W. DUDLEY,  
*Superintendent.*

## REPORT OF ESTES HOWE,

STATE COMMISSIONER.

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CAMBRIDGE, January 8, 1872.

To HON. H. O. HOUGHTON, *Mayor of Cambridge*: —

I HAVE the honor herewith to present a copy of the Report which I have made to His Excellency, the Governor of the Commonwealth, of the results of the observations made under my direction as Commissioner, appointed in pursuance of the provisions of chap. 290 of the Statutes of 1856.

I also transmit a copy of the very valuable and complete Report made to me by J. G. Chase, Esq., City Engineer, embodying the details of the observations upon which the Report is based, together with a very interesting and valuable profile, showing the rise and fall of three ponds in relation to each other.

It is no part of my official duty to add to the above any suggestions of my own; but my early relation to the Water Works has given me more than the common interest of a tax-payer and consumer in all that relates to them. I therefore think I may, without appearing to obtrude officiously, suggest a few ideas that the observations have suggested to me.

*First.* An examination of the profile lines will, I think, naturally suggest the fact that the level of Fresh Pond is very materially affected by the draft made upon it by the pumps.

*Second.* That a very large amount of water flows from Little and Spy Ponds, without being of use to any one.

*Third.* That this may all be utilized by connecting the two last-named ponds with Fresh Pond.

*Fourth.* That this connection should not be by an open ditch, but by a closed conduit.



*Fifth.* That any possibility of a direct flow of surface water from the marsh should be securely guarded against.

*Sixth.* I would suggest, as extremely desirable, the dredging of the shallow part of the pond to such an extent as to prevent the exposure of any mud flats at low water.

If these things be done, I believe the basin in which the three ponds lie will, for many years, afford a sufficient supply of water.

The water of Fresh Pond, except what falls directly upon the surface, all filters through the earth, and appears as springs. The same thing is true of Spy Pond, but Little Pond is on the line of the Waverly Brook, and receives a large portion of its water from that source. An examination of the profile will show how much more rapidly this pond rises and falls than the others. This peculiarity will make it necessary to provide for the diversion of this water from Fresh Pond, when it becomes turbid in consequence of a sudden rise of the brook.

The fact that the surface of Fresh Pond, during the greater part of the period of observation, has been at a point considerably below mean high tide, indicates the necessity of a permanent dam to prevent the reflux of the salt water into the pond.

I am aware that none of these suggestions have the merit of novelty, but they seem to me so important, that I run the risk of seeming tedious, rather than omit any opportunity of giving my testimony upon points that seem to me so important to the future usefulness of the works.

I have the honor to be

Most respectfully yours,

ESTES HOWE.

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CAMBRIDGE, January 2, 1872.

*To His Excellency, WILLIAM CLAFLIX, Governor of the Commonwealth, and the Honorable Council:—*

The subscriber, having been honored by your Excellency, by and with the advice and consent of the Honorable Council, with the appointment of Commissioner, as provided in section three of chapter two hundred and ninety of the Acts of 1856, immediately afterwards proceeded to qualify by taking the required

oaths of office, and gave written notice to the City Government of Cambridge, and by advertisement in the papers of Cambridge, to all other parties interested, of his appointment, and his intention to proceed at once to perform the duties assigned to him, as follows :

CITY OF CAMBRIDGE.

Notice is hereby given to all parties interested, that upon application of the City of Cambridge, and in pursuance of the provisions of the third section of chapter 290 of the Acts of 1856, the undersigned has been appointed by the Governor and Council, " Commissioner to ascertain the points between which the waters of Fresh, Spy, and Little Ponds, and the brooks which are the outlets of said ponds, rise and fall." Communications may be addressed to the undersigned at Cambridge.

ESTES HOWE.

The statute points out no specific mode of procedure on the part of the Commissioner, but leaves that to his discretion. He might have called witnesses living or laboring near the several ponds, and taken their testimony as to their actual observations from time to time ; but, this method was obviously open to a conflict of testimony, and to great doubt and uncertainty in its results. He therefore determined upon the method of actual observation, running through a considerable period. This method is certain as far as it goes ; and, though liable to error because during the period of observation the water line may never have reached its maximum or its minimum, yet it is certainly established that the true maximum must be at least as great as that observed, and the true minimum as small as that observed.

For the purpose of making these observations, Josiah G. Chase, Esq., Engineer of the City of Cambridge, was employed, and stations were fixed at suitable places on the three ponds, and with properly constituted water gauges marked to feet and hundredths. The base line adopted was the standard usual in this neighborhood, twenty feet below the coping of the dry dock at the Navy Yard in Charlestown. The height of the water was observed daily in the morning at each of the stations, and a careful record kept of the results. The observations began on the 13th of April, 1870, and were continued till the 12th of April, 1871, thus giving a complete year.

During that period the highest water noted in Fresh Pond  
 was April 21st-22d, 1870, when the gauge marked . 16.85  
 The lowest water noted was Nov. 22d, 1870, when the  
 gauge marked . . . . . 12.44  
 Showing a range of . . . . . 4.41  
 between high and low water in Fresh Pond.

In Spy Pond, the highest water noted was coincident, in  
 point of time, with that at Fresh Pond, namely, April  
 22d, 1870, when the gauge marked . . . . . 16.60

The lowest water observed was Sept. 23d, 24th, and 25th,  
 when the gauge marked . . . . . 15.14  
 Showing a range of . . . . . 1.46

In Little Pond, the highest water noted was Feb. 21st,  
 1871, when the gauge marked . . . . . 16.50

The lowest water noted was Nov. 22d, 1870, when the  
 gauge marked . . . . . 14.38  
 Showing a range of . . . . . 2.12

A comparison of these observations shows, that during the pe-  
 riod of observation, Fresh Pond was, at one period, higher than  
 either of the other ponds, namely, .25 of a foot, or exactly three  
 inches higher than Spy Pond ; and at the same date, April 22d,  
 1870, was .40 of a foot, or nearly five inches higher than Little  
 Pond, and .35 of a foot, or more than four inches higher than the  
 highest water in Little Pond.

The statute under which I hold my appointment simply re-  
 quires me to "ascertain" the points of high and low water, and  
 if the observations noted above contained all the evidence neces-  
 sary for that purpose, my task would be a simple one ; but, for  
 the reason that the period of observation is necessarily limited,  
 I can only say that I have "ascertained" as to high water in the  
 several ponds, that the point is at least as high as these respect-  
 ively named : —

Fresh Pond . . . . .	16.85
Spy Pond . . . . .	16.60
Little Pond . . . . .	16.50

And that dams on the outlets of the various ponds retaining the  
 waters to the heights indicated, would not cause any flowage  
 greater than the statute allows.

As to the observed point of low water, it is to be noted that during the whole period of observation, water was flowing from Spy and Little Ponds through their natural outlets, most of the time escaping by Alewife Brook to Mystic River, but, during a short period, being constrained by a dam to flow back into Fresh Pond. The minimum point to which those ponds would fall was obviously controlled by the condition of their outlets, both of which are much obstructed by stones and other foreign matters. I feel, therefore, obliged to report that it has not been practicable to "ascertain" the lowest point to which these ponds might flow.

I have caused stone monuments to be set at Spy and Little Ponds, indicating high water mark. Also a mark cut into the granite facing of the gate to the well of the City Water Works at the Engine House on Fresh Pond, indicates high water. These will be sufficiently permanent for reference, and the low water points may at any time, when definitely settled, be determined by measurement.

I have only to add that continuous observation to this date has not shown any greater height of water than that indicated before.

I have the honor to subscribe myself, with the greatest respect,

Your Excellency's obedient servant,

ESTES HOWE.

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OFFICE OF CITY ENGINEER, }  
CAMBRIDGE, *September 25, 1871.* }

HON. ESTES HOWE:—

DEAR SIR, — Directed by you, in the performance of your duties as Commissioner under the Statute of 1856, chap. 290, to ascertain the relative heights and fluctuations of Fresh Pond, Spy Pond, and Little Pond, I have the honor to report:—

Gauges have been established at the three ponds, having a common base which is twenty feet below the coping of the dry dock at Charlestown, and 5.26 feet below mean low water. The heights of water above this base, shown by the readings of the several gauges, have been observed daily for one year, from



April 13, 1870, to April 12, 1871, inclusive, these heights being given in the tables which accompany this report. During the month of October, 1870, additional observations were made, to determine the times and heights of high water at Alewife Brook, where North Avenue crosses the same, and at the outlet of Fresh Pond, the gate being closed to prevent water flowing to or from the pond. A comparison of these data with similar records obtained from the Coast Survey Office of times and heights of tides in Boston Harbor, is also given. And I have prepared a diagram which represents very clearly to the eye the changes and comparative heights of the ponds throughout the year of observation, upon which may be drawn the points settled upon for established heights of high and low water, should they be so determined by you, under the powers conferred upon the Commissioner named in the act referred to.

From an examination of the gauge records, it appears that the highest point reached by water in Fresh Pond was 16.85 on April 21st-22d, 1870. Water in Little Pond on the 21st was .48 below Fresh Pond, and on the 22d .50 lower. Water in Spy Pond was .30 lower than Fresh Pond on the 21st, and .25 lower on the 22d.

Highest water in Spy Pond occurred on April 22d, 1870, being at 16.60.

Highest water in Little Pond occurred February 21st, 1871, being 16.50, at which time the water was .70 lower in Spy Pond and 3.45 feet lower in Fresh Pond.

Lowest point reached in Fresh Pond, 12.44, occurred on the 22d of November, 1870, at which time the water was 2.86 feet higher in Spy Pond, and 1.94 feet higher in Little Pond.

Lowest water in Spy Pond, 15.14, Sept. 23d, 24th, and 25th.

Lowest water in Little Pond, 14.40, Nov. 18th, 21st.

Difference between highest and lowest water in Fresh Pond, 4.41 feet; highest and lowest of Spy Pond, 1.46 feet; highest and lowest of Little Pond, 2.10 feet.

Greatest difference between Fresh and Spy Ponds occurred on the 22d of November, 1870, being 2.86 feet. On the 25th of April, 1870, Fresh Pond was .15 higher than Spy Pond. The nearest approach to the same level again occurred on the 2d of April, 1871, when Fresh Pond was .59 lower than Spy Pond.

Average of the year for Fresh Pond, 14.02. Average of the year for Spy Pond, 15.64. Average of the year for Little Pond, 15.16.

By the observations alluded to, it is shown that, during the month of October, the water in Alewife Brook was constantly above the water in Fresh Pond. The greatest difference was 2.04 feet on Oct. 27th. Without the gate as maintained, a constant stream of deleterious waters would have been received into the pond, putrid from the marshes and accumulations in the stagnant channel of Alewife Brook, as well as salt water thrown back by the tides. A reference to the tide table will also show that the lowest observed tide at outlet of pond during the month of October was higher than the monthly average of the pond from August to February inclusive. That such a gate of separation should be permanently maintained at this point in the brook, to preserve the water supply of Cambridge from needless contamination, is sufficiently evident.

I have also, as directed, set permanent stone monuments at Spy and Little Ponds. The one at Spy Pond is near its outlet to Little Pond, its top indicating extreme high water observed there, and the one at Little Pond being about midway upon its southerly shore, and placed to indicate extreme height of water as observed in said Pond. At Fresh Pond, I have fixed permanently a copper bolt into the northwest granite column of screen room at the Pumping Works, the top of which is placed at the point of extreme high water observed there.

Very respectfully submitted,

J. G. CHASE.

## TABLES

SHOWING HEIGHT OF WATER IN THE PONDS.

APRIL, 1870.

Day of Month.	SPY POND.			LITTLE POND.			FRESH POND.			WEATHER.	Inches Rain-fall.
	A	M	Gauge.	A	M	Gauge.	A	M	Gauge.		
13	-	6	16.44	-	5	16.10	-	5	16.00	Fair.	-
14	6	-	16.48	6	-	16.18	6	-	16.95	Fair	-
15	6	-	16.50	6	-	16.16	6	-	16.00	Fair	-
16	6	-	16.50	6	-	16.15	6	-	16.85	Dull	-
17	6	-	16.50	6	-	16.15	6	-	16.82	Cloudy.	-
18	6	-	16.44	6	-	16.15	6	-	16.85	Some rain.	.46
19	6	-	16.56	6	-	16.45	6	-	16.85	Heavy rain.	1.29
20	6	-	16.56	6	-	16.48	6	-	16.15	Some rain	17
21	6	-	16.55	6	-	16.37	6	-	16.85	Dull	12
22	6	-	16.60	6	-	16.35	6	-	16.85	Dull	.39
23	6½	-	16.55	6	-	-	6	-	16.80	Fair.	-
24	6½	-	16.52	6½	-	16.19	6	-	16.72	Fair	-
25	7	-	16.50	7	-	16.11	6	-	16.65	Some rain	12
26	6	-	16.48	6	-	16.07	6	-	16.95	Fair.	-
27	6	-	16.41	6	-	16.00	6	-	16.91	Fair	-
28	6	-	16.37	6	-	15.98	6	-	16.85	Some rain.	61
29	6	-	16.41	6	-	15.98	6	-	16.75	Fair	-
30	6	-	16.36	6	-	15.94	6	-	16.70	Fair.	-

MAY, 1870.

Day of Month.	SPY POND			LITTLE POND			FRESH POND.			WEATHER.	Inches Rain-fall.
	A	M	Gauge.	A	M	Gauge.	A	M	Gauge.		
1	6½	-	16.37	6½	-	15.81	6	-	16.65	Fair.	-
2	6	-	16.28	6	-	15.80	6	-	16.60	Fair	-
3	6	-	16.26	6	-	15.78	6	-	15.55	Fair.	-
4	6	-	16.22	6	-	15.67	6	-	16.60	Dull	-
5	6	-	16.20	6	-	15.65	6	-	15.45	Fair	-
6	6	-	16.19	6	-	15.61	6	-	16.40	Fair	-
7	6	-	16.16	6	-	15.58	6	-	15.35	Dull	-
8	7½	-	16.15	7½	-	15.54	6	-	15.35	Some rain.	-
9	6	-	16.15	6	-	15.59	6	-	15.32	Rain	-
10	6	-	16.13	6	-	15.69	6	-	15.25	Rain storm.	.31
11	6	-	16.13	6	-	15.60	6	-	15.25	Rain storm.	.86
12	6	-	16.16	6	-	15.69	6	-	16.32	Fair.	-
13	6	-	16.16	6	-	15.67	6	-	16.35	Fair.	-
14	6	-	16.12	6	-	15.65	6	-	15.32	Fair	-
15	6	-	16.11	6	-	15.62	6	-	15.31	Fair.	-
16	6	-	16.09	6	-	15.61	6	-	15.30	Fair.	-
17	6	-	16.07	6	-	15.60	6	-	15.30	Dull.	-
18	6	-	16.06	6	-	15.58	6	-	15.28	Fair	-
19	6	-	16.02	6	-	15.52	6	-	15.28	Fair.	-
20	6	-	16.01	6	-	15.50	6	-	15.24	Hazy.	-
21	6	-	16.00	6	-	15.41	6	-	15.20	Some rain	.08
22	6	-	15.00	6	-	15.32	6	-	15.15	Fair.	-
23	6	-	15.98	6	-	15.25	6	-	15.12	Fair	-
24	6	-	15.98	6	-	15.21	6	-	-	Cloudy.	.03
25	6	-	15.98	6	-	15.21	-	-	-	Foggy	.34
26	6	-	15.96	6	-	15.21	6	-	15.00	Fair	-
27	6	-	15.95	6	-	15.18	-	-	-	Cloudy	-
28	6	-	15.93	6	-	15.15	-	-	-	Rainy	.47
29	6	-	15.95	6	-	15.20	-	-	-	Fair	-
30	6	-	15.95	6	-	15.19	-	-	-	Hazy	-
31	6	-	15.94	6	-	15.19	-	-	-	Fair	-



## JUNE, 1870.

Day of Month.	SPY POND.			LITTLE POND.			FRESH POND.			WEATHER.	Inches Rain-fall.
	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	6	-	15.98	6	-	15.17	-	-	-	Foggy.	-
2	6	-	15.93	6	-	15.17	-	-	-	Fair.	-
3	6	-	15.91	6	-	15.15	-	-	-	Dull.	-
4	6	-	15.40	6	-	15.14	-	-	-	Cloudy.	-
5	6	-	15.89	6	-	15.11	6	-	14.90	Fair.	-
6	6	-	15.88	6	-	15.10	6	-	14.89	Dull.	.09
7	6	-	15.68	6	-	15.10	6	-	14.88	Foggy.	.16
8	6	-	15.49	6	-	15.11	6	-	14.85	Foggy.	.01
9	6	-	15.87	6	-	15.12	6	-	14.86	Cloudy.	.01
10	6	-	15.86	6	-	15.12	6	-	14.88	Misty.	-
11	6	-	15.85	6	-	15.14	6	-	14.85	Rain storm.	.88
12	6	-	15.86	6	-	15.15	6	-	14.85	Foggy.	.01
13	6	-	15.96	6	-	15.18	6	-	14.85	Some rain.	.86
14	6	-	15.91	6	-	15.29	6	-	14.96	Some rain.	.06
15	6	-	15.92	6	-	15.33	6	-	14.95	Fair.	-
16	6	-	15.91	6	-	15.83	6	-	14.90	Fair.	-
17	6	-	15.90	6	-	15.31	6	-	14.92	Fair.	-
18	6	-	15.90	6	-	15.31	6	-	14.92	Fair.	-
19	6	-	15.89	6	-	15.29	6	-	14.92	Fair.	-
20	6	-	15.86	6	-	15.25	6	-	14.90	Some rain.	.48
21	6	-	15.86	6	-	15.34	6	-	14.98	Fair.	.50
22	6	-	15.91	6	-	15.31	6	-	14.95	Fair.	-
23	6	-	15.89	6	-	15.29	6	-	14.90	Dull.	-
24	6	-	15.89	6	-	15.27	6	-	14.89	Fair.	-
25	6	-	15.88	6	-	15.25	6	-	14.88	Fair.	-
26	6	-	15.89	6	-	15.28	6	-	14.85	Cloudy.	.11
27	6	-	15.89	6	-	15.26	6	-	14.85	Dull.	.17
28	6	-	15.88	6	-	15.25	6	-	14.88	Some rain.	.69
29	6	-	15.90	6	-	15.29	6	-	14.92	Fair.	-
30	6	-	15.89	6	-	15.28	6	-	14.91	Rain at night.	.72

## JULY, 1870.

Day of Month.	SPY POND.			LITTLE POND.			FRESH POND.			WEATHER.	Inches Rain-fall.
	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	6	-	15.90	6	-	15.26	6	-	14.95	Fair.	-
2	6	-	15.87	6	-	15.21	6	-	14.90	Clear.	-
3	6	-	15.85	6	-	15.27	6	-	14.88	Dull.	.01
4	6	-	15.85	6	-	15.25	6	-	14.85	Hazy.	-
5	6	-	15.82	6	-	15.25	6	-	14.85	Dull.	-
6	6	-	15.81	6	-	15.25	6	-	14.84	Fair.	-
7	6	-	15.81	6	-	15.24	6	-	14.81	Cloudy.	-
8	6	-	15.84	6	-	15.29	6	-	14.80	Some rain.	.86
9	6	-	15.90	6	-	15.35	6	-	14.90	Fair.	-
10	6	-	15.86	6	-	15.41	6	-	14.88	Fair.	-
11	6	-	15.84	6	-	15.41	6	-	14.85	Some rain.	.12
12	6	-	15.82	6	-	15.40	6	-	14.85	Some rain.	.06
13	6	-	15.82	6	-	15.40	6	-	14.83	Dull.	-
14	6	-	15.81	6	-	15.40	6	-	14.80	Fair.	-
15	6	-	15.79	6	-	15.39	6	-	14.76	Fair.	-
16	6	-	15.77	6	-	15.36	6	-	14.75	Shower.	.12
17	6	-	15.78	6	-	15.35	6	-	14.72	Fair.	-
18	6	-	15.75	6	-	15.33	6	-	14.70	Hazy.	-
19	6	-	15.74	6	-	15.30	6	-	14.70	Fair.	-
20	6	-	15.71	6	-	15.28	6	-	14.66	Dull.	-
21	6	-	15.70	6	-	15.25	6	-	14.65	Hazy.	-
22	6	-	15.69	6	-	15.23	6	-	14.63	Fair.	-
23	6	-	15.68	6	-	15.19	6	-	14.60	Fair.	-
24	6	-	15.48	6	-	15.15	6	-	14.55	Fair.	-
25	6	-	15.65	6	-	15.11	6	-	14.55	Fair.	-
26	6	-	15.64	6	-	15.09	6	-	14.50	Fair.	-
27	6	-	15.63	6	-	15.06	6	-	14.48	Dull.	-
28	6	-	15.60	6	-	15.00	6	-	14.45	Hazy.	-
29	6	-	15.59	6	-	14.98	6	-	14.42	Cloudy.	-
30	6	-	15.58	6	-	14.98	6	-	14.40	Fair.	-
31	6	-	15.56	6	-	14.95	6	-	14.35	Fair.	-

## AUGUST, 1870.

Day of Month	SPY POND.			LITTLE POND.			FRESH POND			WEATHER.	Inches Rain fall.
	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	6	-	15.54	6	-	14.98	6	-	14.30	Fair	-
2	6	-	15.52	6	-	14.87	6	-	14.33	Fair	-
3	6	-	15.50	6	-	14.85	6	-	14.25	Fair	-
4	6	-	15.50	6	-	14.85	6	-	14.23	Showers	.20
5	6	-	15.60	6	-	14.89	6	-	14.20	Fair	-
6	6	-	15.60	6	-	14.87	6	-	14.14	Fair.	-
7	6	-	15.47	6	-	14.50	6	-	14.15	Fair	-
8	6	-	15.58	6	-	14.90	6	-	14.14	Fair	-
9	6	-	15.54	6	-	14.79	6	-	14.10	Fair	-
10	6	-	15.53	6	-	14.75	6	-	14.09	Shower	.70
11	6	-	15.58	6	-	14.79	6	-	14.10	Dull	.05
12	6	-	15.58	6	-	14.79	6	-	14.10	Dull	-
13	6	-	15.57	6	-	14.78	6	-	14.05	Some rain.	.25
14	6	-	15.59	6	-	14.80	6	-	14.00	Fair	-
15	6	-	15.57	6	-	14.78	6	-	14.02	Fair	-
16	6	-	15.56	6	-	14.76	6	-	14.00	Fair	-
17	6	-	15.55	6	-	14.75	6	-	13.98	Fair	-
18	6	-	15.53	6	-	14.74	6	-	13.95	Fair.	-
19	6	-	15.52	6	-	14.71	6	-	13.92	Dull.	-
20	6	-	15.51	6	-	14.70	6	-	14.90	Showers.	.25
21	6	-	15.50	6	-	14.70	6	-	13.83	Fair	-
22	6	-	15.48	6	-	14.73	6	-	13.85	Fair	-
23	6	-	15.45	6	-	14.75	6	-	13.82	Fair	-
24	6	-	15.44	6	-	14.75	6	-	13.80	Fair	-
25	6	-	15.42	6	-	14.75	6	-	13.78	Some rain	.25
26	6	-	15.44	6	-	14.76	6	-	13.78	Fair	-
27	6	-	15.41	6	-	14.77	6	-	13.75	Fair	-
28	6	-	15.38	6	-	14.79	6	-	13.70	Fair	-
29	6	-	15.36	6	-	14.80	6	-	13.69	Some rain.	.05
30	6	-	15.34	6	-	14.83	6	-	13.68	Cloudy	-
31	6	-	15.35	6	-	14.86	6	-	13.68	Fair	-

## SEPTEMBER, 1870.

Day of Month.	SPY POND.			LITTLE POND.			FRESH POND			WEATHER.	Inches Rain fall.
	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	6	-	15.38	6	-	14.85	6	-	13.68	Clear	-
2	6	-	15.32	6	-	14.85	6	-	13.60	Cloudy	-
3	6	-	15.31	6	-	14.85	6	-	13.58	Foggy	.05
4	6	-	15.31	6	-	14.85	6	-	13.56	Clear	-
5	6	-	15.30	6	-	14.83	6	-	13.53	Clear.	-
6	6	-	15.28	6	-	14.78	6	-	13.50	Fair	-
7	6	-	15.25	6	-	14.75	6	-	13.46	Fair	-
8	6	-	15.24	6	-	14.73	6	-	13.40	Fair	-
9	6	-	15.24	6	-	14.72	6	-	13.33	Hazy	-
10	6	-	15.23	6	-	14.70	6	-	13.36	Fair	-
11	6	-	15.21	6	-	14.68	6	-	13.34	Fair	-
12	6	-	15.21	6	-	14.68	6	-	13.31	Fair	-
13	6	-	15.19	6	-	14.65	6	-	13.25	Fair	-
14	6	-	15.17	6	-	14.60	6	-	13.24	Fair	-
15	6	-	15.17	6	-	14.60	6	-	13.21	Fair	-
16	6	-	15.17	6	-	14.59	6	-	13.19	Hazy	-
17	6	-	15.18	6	-	14.58	6	-	13.16	Showers	.15
18	6	-	15.18	6	-	14.56	6	-	13.15	Dull	-
19	6	-	15.17	6	-	14.55	6	-	13.14	Fair	-
20	6	-	15.16	6	-	14.54	6	-	13.11	Fair	-
21	6	-	15.15	6	-	14.53	6	-	13.08	Fair	-
22	6	-	15.15	6	-	14.53	6	-	13.05	Dull.	-
23	6	-	15.14	6	-	14.51	6	-	13.03	Fair	-
24	6	-	15.14	6	-	14.49	6	-	13.01	Rain.	.25
25	6	-	15.14	6	-	14.49	6	-	13.05	Rain	.25
26	6	-	15.23	6	-	14.57	6	-	13.02	Fair	-
27	6	-	15.21	6	-	14.60	6	-	13.01	Fair	-
28	6	-	15.21	6	-	14.59	6	-	12.99	Fair	-
29	6	-	15.21	6	-	14.59	6	-	12.98	Dull	-
30	6	-	15.22	6	-	14.63	-	-	-	Rain.	.25

## OCTOBER, 1870.

Month.	SPY POND			LITTLE POND			FRESH POND			WEATHER.	Inches Rain- fall
	A. M.	P. M.	Gauge	A. M.	P. M.	Gauge	A. M.	P. M.	Gauge		
1	6	-	15.80	6	-	14.75	6	-	12.06	Rain.	.01
2	6	-	15.81	6	-	14.78	6	-	12.02	Fair.	-
3	6	-	15.81	6	-	14.78	6	-	12.01	Some rain	.78
4	6	-	15.84	6	-	14.80	6	-	12.06	Cloudy	-
5	6	-	15.84	6	-	14.80	6	-	12.04	Rain	.43
6	6	-	15.82	6	-	14.82	6	-	12.06	Fair.	-
7	6	-	15.85	6	-	14.83	6	-	12.04	Fair.	-
8	6	-	15.84	6	-	14.81	6	-	12.02	Fair.	-
9	6	-	15.81	6	-	14.78	6	-	12.00	Fair.	-
10	6	-	15.80	6	-	14.75	6	-	12.99	Fair	-
11	6	-	15.80	6	-	14.75	6	-	12.98	Foggy	-
12	6	-	15.80	6	-	14.75	6	-	12.96	Some rain.	.26
13	6	-	15.83	6	-	14.75	6	-	12.00	Hazy.	-
14	6	-	15.80	6	-	14.70	6	-	12.99	Fair	-
15	6	-	15.80	6	-	14.68	6	-	12.98	Fair	-
16	6	-	15.29	6	-	14.67	6	-	12.94	Fair.	-
17	6	-	15.29	6	-	14.68	6	-	12.94	Fair.	-
18	6	-	15.28	6	-	14.68	6	-	12.94	Hazy.	-
19	6	-	15.25	6	-	14.60	6	-	12.83	Fair	-
20	6	-	15.25	6	-	14.58	6	-	12.86	Some rain	1.49
21	6	-	15.24	6	-	14.70	6	-	12.82	Fair	-
22	6	-	15.25	6	-	14.70	6	-	12.89	Fair.	-
23	6	-	15.35	6	-	14.70	6	-	12.88	Fair	-
24	6	-	15.33	6	-	14.68	6	-	12.86	Fair	-
25	6	-	15.33	6	-	14.67	6	-	12.84	Rain at night.	.17
26	6	-	15.34	6	-	14.69	6	-	12.84	Cloudy.	-
27	6	-	15.35	6	-	14.70	6	-	12.81	Cloudy.	.04
28	6	-	15.81	6	-	14.70	6	-	12.79	Fair	-
29	6	-	15.31	6	-	14.70	6	-	12.78	Fair.	-
30	6	-	15.31	6	-	14.70	6	-	12.74	Fair.	-
31	6	-	15.24	6	-	14.71	6	-	12.76	Heavy rain.	.02

## NOVEMBER, 1870.

Month.	SPY POND.			LITTLE POND.			FRESH POND.			WEATHER.	Inches Rain- fall
	A. M.	P. M.	Gauge	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	6	-	15.24	6	-	14.74	6	-	12.76	Fair.	-
2	6	-	15.81	6	-	14.75	6	-	12.73	Fair.	-
3	6	-	15.83	6	-	14.74	6	-	12.71	Shower	.20
4	6	-	15.84	6	-	14.75	6	-	12.73	Fair.	-
5	6	-	15.84	6	-	14.74	6	-	12.71	Dull.	.06
6	6	-	15.84	6	-	14.73	6	-	12.69	Fair.	-
7	6	-	15.83	6	-	14.72	6	-	12.67	Fair	-
8	6	-	15.82	6	-	14.70	6	-	12.65	Hazy	-
9	6	-	15.82	6	-	14.70	6	-	12.63	Some rain.	.32
10	6	-	15.85	6	-	14.74	6	-	12.65	Fair.	-
11	6	-	15.86	6	-	14.75	6	-	12.62	Fair.	-
12	6	-	15.81	6	-	14.65	6	-	12.59	Fair	-
13	6	-	15.81	6	-	14.55	6	-	12.57	Fair.	-
14	6	-	15.80	6	-	14.63	6	-	12.55	Fair.	-
15	6	-	15.80	6	-	14.61	6	-	12.53	Dull.	-
16	6	-	15.80	6	-	14.60	6	-	12.51	Dull.	-
17	6	-	15.80	6	-	14.45	6	-	12.50	Fair.	-
18	6	-	15.82	6	-	14.40	6	-	12.48	Rain.	.22
19	6	-	15.82	6	-	14.48	6	-	12.50	Fair	-
20	6	-	15.82	6	-	14.48	6	-	12.49	Fair.	-
21	6	-	15.31	6	-	14.40	6	-	12.46	Fair.	-
22	6	-	15.30	6	-	14.39	6	-	12.44	Rainy	1.62
23	6	-	15.39	6	-	14.78	6	-	12.61	Foggy	-
24	6	-	15.45	6	-	15.00	6	-	12.64	Dull	-
25	6	-	15.43	6	-	14.97	6	-	12.65	Fair.	-
26	6	-	15.40	6	-	15.00	6	-	12.70	Rain.	.62
27	6	-	15.49	6	-	15.05	6	-	12.73	Fair	-
28	6	-	15.44	6	-	15.01	6	-	12.75	Fair	-
29	6	-	15.43	6	-	14.99	6	-	12.76	Foggy.	.01
30	6	-	15.40	6	-	14.90	6	-	12.76	Fair.	-

## DECEMBER, 1870.

Day of Month.	SPY POND.			LITTLE POND.			FRESH POND.			WEATHER.	Inches Rain-fall.
	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	8	-	15.39	8	-	14.89	8	-	12.75	Fair	-
2	8	-	15.37	8	-	14.80	8	-	12.75	Fair.	-
3	8	-	15.37	8	-	14.78	8	-	12.74	Cloudy.	-
4	8	-	15.37	8	-	14.77	8	-	12.73	Fair	-
5	8	-	15.38	8	-	14.76	8	-	12.73	Foggy	-
6	8	-	15.35	8	-	14.73	8	-	12.72	Cloudy	04
7	8	-	15.35	8	-	14.70	8	-	12.70	Fair	-
8	8	-	15.34	8	-	14.67	8	-	12.70	Rainy	56
9	8	-	15.40	8	-	14.79	8	-	12.76	Fair	-
10	8	-	15.39	8	-	14.78	8	-	12.76	Fair	-
11	8	-	15.35	8	-	14.78	8	-	12.76	Cloudy	-
12	8	-	15.35	8	-	14.78	8	-	12.76	Rainy	-
13	8	-	15.47	8	-	15.10	8	-	12.93	Rainy	1.41
14	8	-	15.47	8	-	15.20	8	-	13.01	Cloudy	-
15	8	-	15.45	8	-	15.20	8	-	13.03	Fair	-
16	8	-	15.45	8	-	15.20	8	-	13.07	Fair	-
17	8	-	15.40	8	-	15.15	8	-	13.10	Fair	-
18	8	-	15.40	8	-	15.15	8	-	13.10	Fair	-
19	8	-	15.35	8	-	15.05	8	-	13.13	Fair.	-
20	8	-	15.35	8	-	15.05	8	-	13.15	Cloudy	42
21	8	-	15.35	8	-	15.05	8	-	13.13	Fair	-
22	8	-	15.35	8	-	15.05	8	-	13.17	Fair	-
23	8	-	15.35	8	-	15.05	8	-	13.16	Snow	-
24	8	-	15.35	8	-	15.05	8	-	13.17	Fair	-
25	8	-	15.35	8	-	15.05	8	-	13.15	Fair	-
26	8	-	15.35	8	-	15.05	8	-	13.15	Cloudy.	-
27	8	-	15.35	8	-	15.05	8	-	13.15	Fair	-
28	8	-	15.35	8	-	15.05	8	-	13.14	Some snow.	-
29	8	-	15.34	8	-	15.00	8	-	13.14	Snow	16
30	8	-	15.38	8	-	15.00	8	-	13.13	Fair	-
31	8	-	15.40	8	-	15.00	8	-	13.13	Some snow.	00

## JANUARY, 1871.

Day of Month.	SPY POND.			LITTLE POND.			FRESH POND.			WEATHER.	Inches Rain-fall.
	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.	A. M.	P. M.	Gauge.		
1	8	-	15.41	8	-	14.98	8	-	13.13	Fair	-
2	8	-	15.42	8	-	14.95	8	-	13.11	Cloudy	-
3	8	-	15.43	8	-	14.99	8	-	13.08	Fair	-
4	8	-	15.43	8	-	14.91	8	-	13.07	Fair	-
5	8	-	15.42	8	-	14.89	8	-	13.05	Fair	-
6	8	-	15.40	8	-	14.87	8	-	13.05	Some rain.	23
7	8	-	15.42	8	-	14.86	8	-	13.05	Fair	-
8	8	-	15.42	8	-	14.85	8	-	13.03	Fair	-
9	8	-	15.45	8	-	14.95	8	-	13.02	Cloudy	-
10	8	-	15.45	8	-	14.95	8	-	13.00	Fair	-
11	8	-	15.45	8	-	14.92	8	-	12.98	Fair	-
12	8	-	15.43	8	-	14.94	8	-	12.96	Fair	-
13	8	-	15.41	8	-	14.88	8	-	12.93	Cloudy	-
14	8	-	15.40	8	-	14.88	8	-	12.90	Fair	-
15	8	-	15.40	8	-	14.85	8	-	12.88	Misty	04
16	8	-	15.45	8	-	14.90	8	-	12.89	Rainy.	56
17	8	-	15.50	8	-	14.97	8	-	12.99	Fair	-
18	8	-	15.51	8	-	15.09	8	-	12.98	Fair	-
19	7	-	15.50	7	-	15.08	8	-	12.98	Cloudy	-
20	7	-	15.50	7	-	15.10	8	-	12.98	Fair	-
21	7	-	15.52	7	-	15.11	8	-	13.00	Some snow	00
22	7	-	15.52	7	-	15.11	8	-	13.02	Cloudy	-
23	7	-	15.52	7	-	15.11	8	-	13.02	Fair	-
24	7	-	15.50	7	-	15.13	8	-	13.02	Snow	-
25	7	-	15.50	8	-	15.13	8	-	13.02	Fair	-
26	7	-	15.51	8	-	15.10	8	-	12.98	Some snow	-
27	7	-	15.50	8	-	15.11	8	-	13.00	Cloudy	-
28	7	-	15.50	8	-	15.11	8	-	12.96	Fair	-
29	7	-	15.51	8	-	15.12	8	-	12.91	Snow	20
30	7	-	15.53	8	-	15.14	8	-	12.87	Fair	-
31	7	-	15.53	8	-	15.16	8	-	12.81	Cloudy	-



## FEBRUARY, 1871.

Day of Month	SPY POND				LITTLE POND				FRESH POND				WEATHER.	Inches Rain-fall.			
	A	M	P	M	Gauge.	A	M	P	M	Gauge.	A	M			P	M	Gauge.
1					15.50	8				15.19	6				12.80	Cloudy	-
2					15.50	8				15.21	6				12.81	Cloudy	.01
3					15.48	8				15.20	6				12.81	Cloudy	-
4					15.48	8				15.20	6				12.79	Fair	-
5					15.48	8				15.20	6				12.75	Fair	-
6					15.50	8				15.20	6				12.75	Fair	-
7					15.50	8				15.20	6				12.73	Fair	-
8					15.50	8				15.19	6				12.70	Some snow	-
9					15.50	8				15.20	6				12.70	Cloudy.	.32
10					15.50	8				15.20	6				12.69	Fair	-
11					15.49	8				15.20	6				12.65	Fair	-
12					15.49	8				15.20	6				12.60	Snow	.72
13					15.49	8				15.20	6				12.66	Fair	-
14					15.49	8				15.20	6				12.63	Snow	.96
15					15.50	8				15.20	6				12.68	Fair	-
16					15.50	8				15.20	6				12.61	Fair	-
17					15.50	8				15.20	6				15.58	Fair	-
18					15.50	8				15.20	6				12.55	Rain	.42
19					15.70	8				15.65	6				12.76	Fair	-
20					15.78	8				16.24	6				12.86	Fair	-
21					16.80	8				16.50	6				13.06	Cloudy	-
22					16.90	8				16.00	6				13.20	Fair	-
23					15.92	8				16.04	6				13.25	Fair	-
24					15.95	8				16.05	6				13.38	Cloudy	-
25					15.98	8				16.05	6				13.65	Fair	-
26					16.00	8				16.09	6				13.81	Cloudy	-
27					16.00	8				15.10	6				13.97	Rain	.18
28					16.00	8				16.08	6				14.05	Fair	-

## MARCH, 1871.

Month	SPY POND				LITTLE POND				FRESH POND				WEATHER.	Inches Rain- fall			
	A	M	P	M	Gauge.	A	M	P	M	Gauge.	A	M			P	M	Gauge.
1	8				16.00	8				16.05	8				14.08	Some rain.	.04
2	8				15.90	8				15.50	8				14.10	Fair	-
3	8				15.85	8				15.37	8				14.12	Cloudy	-
4	8				15.80	8				15.40	8				14.15	Cloudy.	.06
5	8				15.78	8				15.35	8				14.15	Fair.	-
6	8				15.75	8				15.32	8				14.19	Cloudy	.08
7	8				15.73	8				15.30	8				14.21	Fair	-
8	8				15.70	8				15.28	8				14.23	Fair	-
9	8				15.68	8				15.25	6				14.26	Cloudy.	-
10	8				15.68	8				15.30	8				14.27	Some rain.	.20
11	8				15.68	8				15.30	8				14.30	Rainy	.19
12	8				15.68	8				15.32	8				14.43	Rainy.	.28
13	8				15.70	8				15.40	8				14.50	Cloudy	-
14	8				15.70	8				15.38	8				14.52	Fair	-
15	8				15.60	8				15.30	8				14.54	Fair	-
16	8				15.60	8				15.28	8				14.55	Cloudy.	.12
17	8				15.60	8				15.25	8				14.55	Rainy.	.09
18	8				15.60	8				15.22	8				14.55	Cloudy	-
19	8				15.60	8				15.20	8				14.54	Fair	-
20	8				15.58	8				15.18	8				14.55	Fair	-
21	8				15.52	8				15.21	8				14.60	Rain	2.17
22	8				15.32	8				15.91	8				14.90	Cloudy	.08
23	8				16.81	8				16.73	8				15.07	Cloudy	-
24	8				15.79	8				15.65	8				15.10	Fair.	-
25	8				15.75	8				15.65	8				15.09	Fair	-
26	8				15.73	8				15.43	8				15.08	Fair.	-
27	8				15.70	8				15.35	8				15.09	Snow	.54
28	8				15.71	8				15.40	8				15.11	Cloudy.	-
29	8				15.70	8				15.40	8				15.10	Fair	-
30	8				15.69	8				15.37	6				15.08	Cloudy	-
31	8				15.69	8				15.32	8				15.05	Fair	-



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## OCTOBER, 1870. HIGH TIDES.

Day of Month.	BOSTON HARBOR.			BROOK AT NORTH AV.			BROOK AT FRESH P.			FRESH POND.	Brook above Pond.	Tide at Pond later than Tide at Harbor.
	A. M.	P. M.	Height.	A. M.	P. M.	Height.	A. M.	P. M.	Height.			
1	h. m.	h. m.		h. m.	h. m.		h. m.	h. m.				h. m.
2	4 10	-	15.22	-	-	-	7 81	-	14.70	12.00	1.65	3 21
3	5 15	-	14.73	6 30	-	14.97	8 23	-	14.45	12.03	1.64	3 08
4	6 25	-	14.59	7 50	-	14.80	9 40	-	14.38	12.01	1.57	3 15
5	7 39	-	15.08	8 45	-	15 18	10 39	-	14.71	12.07	1.66	3 10
6	8 31	-	14.93	-	-	-	11 56	-	14.56	12.04	1.64	3 26
7	9 35	-	15.46	-	-	-	-	1 32	14.78	12.06	1.67	3 57
8	10 06	-	15.41	-	-	-	-	1 58	14.69	12.04	1.65	3 52
9	11 00	-	15.32	-	12 20	15.16	-	2 42	14.55	12.02	1.64	3 42
10	11 33	-	15.40	-	1 00	15.21	-	3 30	14.58	12.00	1.58	3 57
11	-	12 08	15.52	-	1 45	15.25	-	4 15	14.54	12.09	1.55	4 09
12	-	12 41	15.38	-	2 20	15.30	-	4 24	14.54	12.06	1.58	3 53
13	-	1 17	15.11	-	3 00	15.33	-	5 12	14.65	12.06	1.61	3 55
14	-	1 59	15.50	-	3 40	15.25	-	6 03	14.64	12.00	1.64	4 04
15	-	3 22	14.85	-	4 50	14.82	-	-	-	12.09	1.59	-
16	-	3 12	14.58	-	4 27	14.60	-	-	-	12.06	1.04	-
17	-	3 55	14.24	-	5 10	14.45	-	-	-	12.06	1.01	-
18	-	4 47	13.97	-	5 50	14.22	-	-	-	12.04	.99	-
19	5 39	-	13.89	6 40	-	13.75	-	-	-	12.04	.98	-
20	6 32	-	12.76	8 00	-	13.37	-	-	-	12.00	1.00	-
21	7 34	-	14.69	8 48	-	14.63	-	1 10	14.04	12.00	1.24	5 36
22	8 12	-	14.82	9 20	-	14.55	11 10	-	14.34	12.02	1.42	2 58
23	9 23	-	15.48	11 00	-	15.20	-	1 08	14.56	12.09	1.67	3 40
24	10 07	-	15.24	11 45	-	14.87	-	1 27	14.47	12.08	1.59	3 20
25	10 53	-	16.20	-	1 00	15.44	-	3 20	14.67	12.06	1.81	4 27
26	11 48	-	15.28	-	1 53	15.47	-	4 17	14.71	12.04	1.87	4 26
27	-	12 41	17.73	-	3 00	15.70	-	5 25	14.35	12.04	2.01	4 44
28	-	1 30	16.58	-	3 50	15.65	-	6 14	14.35	12.01	2.04	4 44
29	-	2 17	15.99	-	4 10	15.40	-	-	-	12.79	1.61	-
30	-	3 07	15.59	-	4 45	15.22	-	-	-	12.76	1.79	-
31	3 57	-	14.27	-	5 30	14.80	8 18	-	14.07	12.74	1.61	4 21
	5 03	-	14.80	6 00	-	14.90	8 28	-	14.54	12.76	1.78	3 25





City of Cambridge.

THE  
EIGHTH ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL,

TOGETHER WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
AND OTHER DOCUMENTS.

FOR THE YEAR 1872



CAMBRIDGE:

PRESS OF JOHN WILSON AND SON

1873.







City of Cambridge.

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32025  
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1873.

★ CAMBRIDGE PUB. LBRY



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# REPORT

## OF THE

### CAMBRIDGE WATER BOARD.

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As required by the City Ordinance, the Cambridge Water Board herewith submit to the City Council their Eighth Annual Report:—

The net cost of the Water Works, to Nov. 30, 1871, as appears by our last Annual Report, was	\$945,146.45
There has been expended for extension for the year ending Nov. 30, 1872 . . . . .	85,238.41
Making the cost of Water Works, Nov. 30, 1872 . . . . .	\$1,030,384.86
The receipts for water rates for the year ending Nov. 30, 1872, were . . . . .	\$127,201.30
Receipts for same time in year 1871 . . . . .	111,782.65
Showing the increase for 1872 to be . . . .	\$15,418.65

The following statement will show in brief the entire transactions on account of the Water Works for the year ending Nov. 30, 1872:—

#### Received.

Total appropriations for extension account . . . .	\$250,000.00
Less amount transferred to "care and repair" and to "supply account" . . . . .	7,500.00
Leaving balance to extension account . . . .	\$242,500.00

## WATER WORKS.

Amount brought forward . . . . .	\$242,500.00
Received from water rates . . . . .	127,201.30
From supply account and shutting off and letting on the water . . . . .	13,495.91
From sale of old iron, &c. . . . .	1,054.48
Balance of interest from the City Treasurer on Temporary Loan . . . . .	2,629.32
Interest from the Sinking Fund . . . . .	4,472.60
	<b>\$391,353.61</b>

**Expended.**

For extension account . . . . .	\$85,238.41
„ care and repairs . . . . .	24,513.14
„ supply account . . . . .	16,429.49
„ interest on Water Debt to Nov. 30, 1872 . .	53,484.00
Amount of appropriation unexpended . . . . .	157,261.59
Balance, showing gain in 1872 . . . . .	54,426.98
	<b>\$391,353.61</b>

By the foregoing account it will be seen that the appropriation for extension account was . . .	\$242,500.00
Amount expended . . . . .	85,261.59
Leaving amount unexpended, and which lapsed into the City Treasury, Nov. 30, 1872 . .	<b>\$157,261.59</b>

Against this unexpended amount of appropriation for the extension account contracts have been made and work commenced, upon which there will be due about as follows, say —

On contract for foundations, &c., at new engine-house	\$17,500.00
On contract for new engine and boiler house above the foundations . . . . .	44,900.00
On contract for conduit from deep water in the pond to new well-room . . . . .	16,000.00
On contract for a new "Worthington pump" . .	18,000.00
On contract for new main pipe leading from the reservoir to North Cambridge . . . . .	7,500.00
On contract for stone for foundations . . . . .	3,500.00
Estimated cost of engine-house lot, and grading .	6,000.00
	<b>\$113,400.00</b>

At the time the estimates were made up by the Water Board, and the amount of appropriation asked for, the water in the pond was unusually low for that time in the year, and it was deemed very important that a connection should be made as soon as possible with Little and Spy Ponds to increase our water supply, and also that we should improve the time of low water to remove from the pond a large amount of vegetable matter, which, being exposed to the sun, by decay and fermentation contaminated the water. For these purposes there was included in the estimates, —

For connecting conduit between the ponds . . . .	\$30,000
For removing vegetable matter from pond . . . .	20,000

The copious rains which we had early in the season removed all fear of a short supply of water this year, and at the same time made it an unfavorable time to prosecute either of the proposed plans before named.

None of the money asked for, and intended for these purposes, therefore, has been used. The importance of this work still remains, and the delay in doing it can be only temporary. At some future time, when the stage of the water favors doing the work, we shall again ask for an appropriation for this purpose.

In connection with the subject of our water supply we would again call attention to our recommendation in our last Annual Report, from which we quote as follows : —

"We find there are other small sources of water supply in Middlesex County, which may be of great use to us if we could secure them. In view of the foregoing, and also to provide for the prospective wants of our rapidly growing city, we recommend the City Council to make application to the Legislature as follows : —

"*First.* For leave to raise the ponds above high-water mark, and to shut out the fish.

"*Second.* That we be permitted to take the water from such streams in this county (the right of which is not already granted to others) as we can bring to advantage to reinforce our present water supply."

By the former we shall be enabled to save and store in the ponds, when necessary, a large amount of water that otherwise

would run out, and by the latter we may secure a means of reinforcing our supply at some future time, when it may be much needed.

The following table will show the comparative rainfall during the past two years by months, and also the height of the water in the pond at the same time : —

	Rainfall. 1870-71 Inches	Rainfall 1871-72. Inches.	Above low- water mark 1870-71. Inches.	Above low- water mark 1871-72 Inches
December . . . . .	2.71	3.18	9	12.8
January . . . . .	1.45	1.93	8.4	16
February . . . . .	2.63	2.3	11.6	13
March . . . . .	3.7	3.09	83	15
April . . . . .	8.03	2.68	82.6	27
May . . . . .	3.6	3.51	82	26
June . . . . .	5.35	4.64	24	31
July . . . . .	2.96	5.17	14.5	28
August . . . . .	3.1	10.97	19	35
September . . . . .	1.08	6.67	4	44
October . . . . .	5.7	3.66	5	38
November . . . . .	4.78	4.18	8	43
	40.09	51.98		

By this it appears that the amount of rainfall in 1872 exceeded that of 1871 by 11.89 inches, and also that the water in the pond at the end of the year was 35 inches higher in 1872 than in 1871. This additional amount of water in storage equals 175,000,000 gallons, and by reference to the Superintendent's Report you will see that, besides this large amount retained, there has been a steady outflow from the pond since September. From this statement it can be seen that we might store a large amount of water for use if we were permitted to raise the pond to meet our wants, as hereinbefore suggested.

A series of observations was made at the engine-house for the purpose of ascertaining the amount of water delivered at each revolution of the pump. As a result it was found that 300 gallons per revolution was the correct amount, instead of 320 gallons, as we had before calculated.

A comparison of the pumping this year with last year, after making up last year's pumping on the basis of 300 gallons, which is the amount we use in all our calculations now, would be as follows : —



Amount pumped last year, upon a basis of 320 gal- lons per revolution, as per last year's report . . .	637,912,150
Less difference to equal 300 gallons . . . . .	39,869,510
	598,042,640

Average amount pumped per day, 1871 . . . . .	1,638,473
Amount pumped this year, per record . . . . .	593,492,156
Average amount pumped per day, 1872 . . . . .	1,626,006

Showing a decrease, on an average, of 12,467 gallons per day.

This decrease, while we have been constantly increasing the number of water takers, is accounted for in part by the fact that we are getting rid of nearly all the old decayed and leaky pipes, from which we have lost much in the past; and also from the fact that during the season we have had frequent rains, thus greatly reducing the amount of water used in watering streets and gardens.

Early in the season, in connection with the matter of providing a place for the new pump that had been contracted for, the subject of moving our pumping-engine house, and building our Water Works on a scale commensurate with the prospective wants of the city, came up for consideration. After a long and thorough canvassing of the whole matter, it was decided to remove; a piece of land was taken for the location, and \$100,000 appropriated for the purpose of erecting buildings, with the necessary connections to accommodate three of Worthington's duplex pumping engines, with a united capacity of 15,000,000 to 20,000,000 gallons per day.

The season had well advanced before the appropriation was made for this purpose. No time was lost after that; and as soon as satisfactory plans were procured and adopted, work was commenced on the foundations, which has been steadily prosecuted under the charge of the City Engineer up to this time. Owing to the great amount of rainy weather during the fall season and the presence of quicksand in the soil, the work of getting in the new well-room has progressed slowly. But in face of all hindrances the main well-room is nearly done, a large part of the foundation walls are laid, and the buildings and chimney are contracted to be finished by August 1, 1873. We hope during the next year to have

this work substantially complete, with two pumps in working order, either one of which will be of sufficient capacity to supply the city with water for some years to come. Some progress has also been made in building the new conduit out into the pond. In the new well-room, and in laying this new conduit, we have gone four feet lower than the old conduit; and we also take the water where it is deep, and away from the prevailing currents in the pond, thus getting better water, while at the same time we make available an increased storage capacity, equal to 240,000,000 gallons in Fresh Pond alone.

In the judgment of this Board no water works can be considered complete until all the principal appliances for furnishing the supply are duplicated. The arrangements already made will furnish the necessary duplicate pumping power, and we now need another pumping main pipe leading from the engine-house to the reservoir, and also another distributing main pipe leading from the reservoir down through the city for nearly its entire length.

Several times during the past year we have been stopped on account of breakages in our pumping main, once for three days and nights, when nearly all the water was drawn from our reservoir before we could resume pumping. Had a fire occurred during this time requiring a large amount of water, we can hardly imagine the amount of damage that might have ensued. The experience of our neighboring city is a warning to us to provide all we can against a similar calamity in our midst. We cannot consider this matter too seriously.

To a certain extent the same difficulty might and has occurred in our distributing main from the reservoir. At present we have two, one twenty-four inch and one twelve inch. When an accident occurred, by which it became necessary to shut off the twenty-four inch main, the supply was reduced to a minimum, and complaints came from all parts of the city, and some of our largest takers in the lower part of the city were almost cut off from any supply. Had a large fire occurred at this time we should have been in great danger. Aside from the danger of fire the legitimate use of the water requires us to duplicate the supply main. The largest consumers in the city have already been seriously damaged by having the water cut off, from an accident to the only main supply that

would furnish them with the water they needed, and at the same time others suffered more or less from the same cause. To lay these large main pipes is expensive, and we thus call your attention to the importance of this subject, that if we should ask for a large appropriation for "extension account," to enable us to lay these large mains, you would understand the importance of the matter, and we shall have performed our duty in presenting it for your consideration.

Our experience has taught us that the most favorable time for the City to make contracts for its pipes is in the winter, and before the annual appropriations are made. After deciding what we shall need for the ensuing year, it is our intention to ask from you the right to make contracts for the pipes in anticipation of the appropriations ; but no money will be needed before the usual time to pay on account of any such contracts.

For a detailed account of what has been done the past year, and the present condition of the Water Works, we would respectfully refer you to the Reports of the Water Registrar and the Superintendent, herewith transmitted, in accordance with the requirement of the City ordinance. We congratulate the City on the good condition of the works as they now are ; and when the improvements already begun are completed, we think our Water Works, in point of efficiency and economy, will stand equal to any in the country, where the water is furnished by pumping.

We were gratified at the prompt action of the City Council in voting to put in a sewer in Concord Avenue and Vassal Lane, by which a large amount of surface drainage on the easterly side of the pond can be kept out of the pond and carried below the outlet into Alewife Brook, while at the same time we can properly drain the new pumping works that are being erected. The subject of protecting our water supply from the drainage around the pond is an all-important one, and appeals to the personal interest of every one who uses the water. The sewer already voted in will undoubtedly, in the end, be a part of a continuous one reaching entirely around the pond. As the borders of the pond become more thickly settled the necessity of this course will present itself more and more.

The movement now being made to annex to our city portions of the adjoining towns, so that the whole of Fresh Pond will come



within our borders, is an important one as bearing on the Water Works. If this should be accomplished, we then can make such improvements on the borders of the pond for our protection as may be required; and as all such improvements will naturally enhance the value of the surrounding property, the City will get the advantage of this increased valuation in taxation. This would particularly be the case if, as has been recommended, the City should build a driveway around the pond, which, while it protected our water interests, would at the same time open one of the most desirable locations for elegant private residences in the vicinity of Boston.

In closing our Report we wish to bear testimony to the general faithfulness of the persons employed by this Board, but especially to the untiring efforts of our Superintendent, who, by day and night, has devoted himself to the interests of the Water Works in all its departments, and we consider the City fortunate in securing his services in the position he occupies.

All of which is respectfully submitted.

J. WARREN MERRILL,  
HENRY O. HOUGHTON,  
ALVAN BLODGETT,  
HENRY L. EUSTIS,  
SAMUEL SLOCOMB,  
GEORGE P. CARTER,  
CHESTER W. KINGSLEY,

} *Cambridge*  
*Water Board.*

# REPORT

OF

## THE WATER REGISTRAR.

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WATER REGISTRAR'S OFFICE, }  
CAMBRIDGE, Dec. 1, 1872. }

*To the Cambridge Water Board: —*

GENTLEMEN, — In conformity with the requirements of the City ordinance for the care and management of the Cambridge Water Works, the Water Registrar hereby respectfully submits his Report for the year ending Nov. 30, 1872.

### Receipts.

Water rates . . . . .	\$127,201.30
Supply account for pipe, laying, and repairing . .	13,344.91
Chapman Valve Co., gates . . . . .	189.60
Rent of house, Pipe yard (three months) . . .	37.50
Shutting off and letting on water . . . . .	151.00
Walworth Manufacturing Co., old iron . . . . .	827.38
<hr/>	
Total cash receipts from all sources . . . . .	\$141,751.69
All of which has been paid into the City Treasury.	
The increased amount of income for the financial	
year over the previous year is . . . . .	\$14,218.19

### Expenditures.

The expenditures for the care and management of the Works for the year ending Nov. 30, 1872, have been as follows: —

For care and repairs . . . . .	\$10,959.75
For pumping service . . . . .	8,716.94
For office expenses . . . . .	4,836.42
Total amount . . . . .	\$24,513.11

The expenditures on the extension of the Works for the year ending Nov. 30, 1872, were . . . . .	\$72,238.41
The expenditure on supply account was . . . . .	16,429.42

The following table exhibits the yearly revenue received from water rates, since the purchase of the Works by the City : —

From April 28, 1865, to Dec. 1, 1865 . . . . .	\$32,367.19
„ Dec. 1, 1865, „ 1866 . . . . .	40,073.27
„ „ 1866, „ 1867 . . . . .	52,733.62
„ „ 1867, „ 1868 . . . . .	63,747.42
„ „ 1868, „ 1869 . . . . .	76,149.30
„ „ 1869, „ 1870 . . . . .	92,606.95
„ „ 1870, „ 1871 . . . . .	111,782.65
„ „ 1871, „ 1872 . . . . .	127,201.30
	\$596,661.70

The water has been shut off from the premises of water takers for non-payment of rates, one hundred and eleven times. Of this number seventy-five have been let on, leaving a balance of thirty-six still remaining off.

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, &c., SUPPLIED WITH FRESH POND WATER TO DEC 1, 1872.

7758 Families.
750 Hand Hose.
538 Private Stables.
160 Stores.
78 Stationary Engines.
40 Offices.

- 40 Saloons.
- 29 Meat Markets.
- 27 School-houses.
- 24 Barber Shops.
- 23 Boarding Houses.
- 17 Greenhouses.
- 15 Bake-houses.
- 14 Soap Manufactories.
- 14 Blacksmith Shops.
- 13 College Buildings.
- 11 Livery Stables.
- 9 Churches.
- 8 Furniture Manufactories.
- 8 Fish Markets.
- 8 Machine Shops.
- 8 Billiard Halls.
- 8 Lumber Wharves.
- 7 Public Halls.
- 7 Horse Railroad Stables.
- 7 Club Rooms.
- 6 Printing Offices.
- 6 Banks.
- 6 Public Houses.
- 6 Carpenter Shops.
- 6 Coal Wharves.
- 6 Lodging Houses.
- 5 Stone Yards.
- 5 Police Stations.
- 5 Carriage Manufactories.
- 5 Paint Shops.
- 5 Cow Pastures.
- 4 Photograph Rooms.
- 4 Engine Houses
- 4 Slaughter Houses.
- 4 Iron Foundries.
- 4 Cooper Shops.
- 4 Harness Shops.
- 4 Post Offices.

- 4 Marble Works.
- 4 Planing Mills.
- 3 Glass Works.
- 3 Cigar Manufactories.
- 3 Nurseries.
- 3 Organ Factories.
- 3 Steam Railroad Depots.
- 3 Plumber Shops.
- 2 Cider Refineries.
- 2 Tin Ware Manufactories.
- 2 Chemical Works.
- 2 Club Stables.
- 2 Bacon Works.
- 2 Tallow Factories.
- 2 Private Schools.
- 2 Brush Manufactories.
- 2 Laboratories.
- 2 Steam Railroads.
- 2 I. O. of O. F. Halls.
- 2 Masonic Halls.
- 2 City Stables.
- 2 Confectionery Manufactories.
- 2 Aquariums.
- 1 Ice Tool Manufactory.
- 1 Coffin Manufactory.
- 1 Fruit Preserving Company.
- 1 Box Manufactory.
- 1 Cattle Yard.
- 1 Library.
- 1 Stereotype Foundry.
- 1 Almshouse.
- 1 Brass Foundry.
- 1 Brewery.
- 1 Boiler Manufactory.
- 1 Botanic Garden.
- 1 Brick Yard.
- 1 Currier Shop.
- 1 Color Manufactory.

- 1 City Hall.
- 1 City Wharf.
- 1 Cemetery.
- 1 Drain Pipe Manufactory.
- 1 Distillery.
- 1 G. A. R. Hall.
- 1 Gas Works.
- 1 Gymnasium.
- 1 House of Correction.
- 1 Laundry.
- 1 Lead Pipe Works.
- 1 Lard Works.
- 1 Museum of Comparative Zoölogy.
- 1 Lobster House.
- 1 Last Factory.
- 1 Ice Company.
- 1 Spring Bed Manufactory.
- 1 Hardware Manufactory.
- 1 Oil Factory.
- 1 Paper Collar Manufactory.
- 1 Rolling Mill.
- 1 Sausage Manufactory.
- 1 Sugar Refinery.
- 1 Swine Yard.
- 1 Grapery.
- 1 Bleachery.
- 1 Car Wheel Company.
- 1 Lock-up.
- 1 Frame and Moulding Manufactory.
- 1 Oiled Hat and Clothing Manufactory.

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## STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE  
PREMISES OF WATER TAKERS IN THE CITY OF CAMBRIDGE, DEC. 1, 1872.

- 9170 Faucets.
- 2277 Wash Bowls.
- 2142 Water Closets.

- 1203 Bath Tubs.  
 1108 Wash Tubs.  
 290 Slop Closets.  
 90 Yard Hydrants for Family Use.  
 83 Garden Hydrants for Hand Hose.  
 7 Private Fountains.

During the year, three meters have been applied and three removed from the premises of water takers, making the total number now in use eighty-one. They are attached to a variety of manufacturing establishments as follows:—

WHERE ATTACHED.	SIZE OF METERS						
	$\frac{1}{2}$ inch.	$\frac{3}{4}$ inch.	1 inch.	$1\frac{1}{4}$ inch.	2 inch.	3 inch.	4 inch.
Asa Gray . . . . .			1				
Bay State Glass Co. . . . .					1		
Batchelder, Moore, & Co. . . . .				1			
Braman, Shaw, & Co. . . . .				1			
Boston and Albany Railroad Co. . . . .					1		
Boston and Lowell Railroad Co. . . . .			1		3		1
Boston Chemical Works . . . . .					1		
Boston Rolling Mill . . . . .					1		
Boston Stamping and Manufacturing Co. . . . .			1				
Boston Car Wheel Co. . . . .		1					
Beal & Hooper . . . . .					1		
B. P. Clark & Co. . . . .			1				
Brazier & Whittemore . . . . .			2				
Bay State Color Co. . . . .					1		
C. L. Jones . . . . .			1				
Cambridge Gas Light Co. . . . .						1	
Cambridge Stamping Co. . . . .	1	1					
Curtis Davis . . . . .				1			
Doe & Hunnewell . . . . .				1			
Francis Draper & Co. . . . .		1					
F. Geldowsky . . . . .				1			
George G. Page & Co. . . . .			1				
George Woods & Co. . . . .				1			
House of Correction . . . . .					1		
H. O. Houghton & Co. . . . .			1				
Henry Thayer & Co. . . . .					1		
Hancock & Greely . . . . .				1			
H. M. Clark . . . . .		1					
Holyoke House . . . . .					1		
John K. Hodgdon . . . . .					1		
James McIntosh . . . . .			1				
John P. Squire & Co. . . . .		1			1		
John Wilson & Son . . . . .			1				
John Reardon & Sons . . . . .			1				
J. J. Gray . . . . .			1				
James C. Davis . . . . .			1				
James B. Kent . . . . .			1				
Joseph Boynton . . . . .	1						
James Lee . . . . .			1				



WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{3}{4}$ inch.	$\frac{1}{2}$ inch.	1 inch.	1 $\frac{1}{2}$ inch.	2 inch.	3 inch.	4 inch.
Leonard Cox . . . . .	.	1	.	.	.	.	.
Little & Brown . . . . .	.	.	1	.	.	.	.
Lyman Kinsley & Co. . . . .	.	.	.	.	1	.	.
Mt. Auburn Cemetery . . . . .	.	.	.	1	1	.	.
Mason & Hamlin . . . . .	.	.	1	.	.	.	.
Middlesex Bleachery . . . . .	.	1	.	.	.	.	.
North, Meriam, & Co. . . . .	.	.	.	.	1	.	.
New England Glass Co. . . . .	.	.	.	.	1	.	.
O. S. Bullock . . . . .	.	.	1	.	.	.	.
Prospect House . . . . .	.	.	.	1	.	.	.
Revere Sugar Refinery . . . . .	.	.	.	.	1	.	.
Reversible Collar Co. . . . .	.	.	.	.	1	.	.
Shawmut Iron Works . . . . .	.	1	.	.	.	.	.
Sylvester Tower . . . . .	.	.	1	.	.	.	.
S. M. Cofran . . . . .	.	.	.	.	1	.	.
St. Mary's Church . . . . .	.	.	.	.	1	.	.
Thayer Club . . . . .	.	1	.	.	.	.	.
T. S. Huckins . . . . .	.	.	1	.	.	.	.
Theodore Downing . . . . .	.	.	1	.	.	.	.
Union Glass Co. . . . .	.	1	2	.	.	.	.
Union Railway Co. . . . .	.	6	2	2	.	.	.
Woodbury & Co. . . . .	.	.	.	.	1	.	.
Welch, Bigelow, & Co. . . . .	.	1	.	.	.	.	.

As required by the City ordinance, all buildings supplied with Fresh Pond water have been visited during the year.

Respectfully submitted.

A. F. FIFIELD,  
*Water Registrar.*

**REPORT**  
**CONCERNING**  
**THE ACCOUNTS OF THE WATER REGISTRAR.**

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**IN CAMBRIDGE WATER BOARD, }**  
**Dec. 7, 1872.**

**THE Committee appointed to examine the accounts of the Water Registrar for the financial year ending Nov. 30, 1872, herewith submit the following**

**REPORT:**

**Your Committee have examined the books and accounts of the Water Registrar, and compared them with the vouchers, and find that the same are correct.**

**Respectfully submitted.**

**SAMUEL SLOCOMB, }**  
**GEORGE P. CARTER, }** *Committee.*

# REPORT

## OF THE

### SUPERINTENDENT OF THE WATER WORKS.

*To the Cambridge Water Board:—*

GENTLEMEN, — The undersigned respectfully submits the Eighth Annual Report of the Superintendent of the Water Works, which embraces a complete statement of all the work performed under his direction, for the year ending Nov. 30, 1872.

#### Pond.

In December, 1871, the gates at the outlet of the pond were raised, and remained opened until the twenty-eighth of the month, to allow the fish to escape from the pond. On the twenty-ninth of the month, the lower gates, on Alewife brook, at the Lexington Branch Railroad, were closed, to prevent the drainage from flowing back into the pond. In April and May, the gates at the outlet of the pond were open the entire time, to allow the fish to return to the pond. In September, the gates at the outlet of the pond were again opened, and remain open at the present time, during which time there has been a continual flow of water out of the pond. The following table shows the height of the water in the pond at the end of each month of the year.

December, . . . . .	3 ft. 8 in.	below the highest point known.
January, . . . . .	3 " 1 "	" " " " " "
February, . . . . .	3 " 4 "	" " " " " "
March, . . . . .	3 " 2 "	" " " " " "
April, . . . . .	2 " 2 "	" " " " " "
May . . . . .	2 " 3 "	" " " " " "
June, . . . . .	1 " 10½ "	" " " " " "
July, . . . . .	2 " 8 "	" " " " " "
August, . . . . .	1 " 6 "	" " " " " "
September, . . . . .	0 " 9 "	" " " " " "
October, . . . . .	1 " 3½ "	" " " " " "
November, . . . . .	0 " 10 "	" " " " " "

### Engine House.

There have been no repairs made on the buildings during the year. The small well-room has been connected with the large one, and the small pumps have been overhauled and put in working order, and were started the first day of November, 1872, and the working of the large pumping engine was suspended at that time, for repairs, after being in constant use for four years. We have at the present time 564 tons of coal on hand. There were 593,492,156 gallons of water pumped the last year, consuming 1,522,650 pounds of coal. The average number of gallons pumped daily was 1,626,006, an average decrease of 12,467 gallons per day (estimating last year's pumping at 300 gallons per revolution, the same as this year's pumping is made up). The daily time of pumping for the first eleven months of the year averaged seven hours and fifty-eight minutes.

### Force Main.

During the year, four leaks have been stopped, all of which were in joints. On the 25th of December, 1871, the Y branch under the railroad track, connecting both sets of pumping engines, broke, and was removed at that time. The large pumping engine was connected with a straight length of pipe. In November, 1872, this connection was broken, and another Y branch was put in to connect both sets of pumping engines. On the twelfth day of November, the Y branch again broke, while the working of the large pumping engine was suspended for repairs, and the small pumping engines were connected with a straight length of pipe.

### Reservoirs.

No repairs of any importance have been made on either during the year. It will become necessary to make some repairs on the retaining wall on the westerly side of the large reservoir, another season.

### Distribution Pipes.

Nearly five miles of pipe have been laid the present season, making the total length of pipe in the city at the present time about seventy-two miles. Five hundred and four leaks have been

stopped, as follows: One hundred and eighty in service pipes; ninety-seven in hose-bibb cocks; eighty-four in joints; forty-four in service cocks; twenty-six in fire hydrants; twenty-four in yard hydrants; twenty-three in stop and waste cocks; eleven in defective pipes; five in meters; three in gates; two broken pipes caused by settlement; two at wooden plugs in ends of pipes; and in one cast iron cap at end of pipe. During the year a new line of six-inch pipe has been laid the entire length of Webster Avenue, and seven fire hydrants, and all of the service pipes formerly connected with the three-inch cast iron pipe and the old aqueduct log have been connected therewith. The old wooden log is now entirely abandoned. In River Street, from Fremont Street to Riverside, a six-inch pipe has been laid, and the three-inch and four-inch pipes have all been taken up. This relieves that portion of the city, which has long needed a larger supply of water for manufacturing and other purposes, and also gives a better protection in case of fire. In Mellen Street, near North Avenue, where there was great complaint on account of the unfitness of the water for washing purposes, the three-inch pipe was removed, and found to be badly corroded, and four hundred and ninety feet of dipped four-inch pipe laid in its place. The same trouble was experienced at the Cambridge Laundry in Soden Street, and the three-inch pipe in that street was removed, and a four-inch pipe substituted. The three-inch and four-inch pipes in Columbia Street, between Broadway and Main Street, have been removed, and a twelve-inch pipe laid instead. The past winter was one of uncommon severity, the frost penetrating the ground to an unusual depth; in many instances, main and supply pipes were frozen which had never been before. One hundred and twenty pipes were thawed out, which were found to be frozen in the street, and one hundred and two in the premises of water takers. All main and supply pipes frozen last winter have been lowered this season. In all cases where complaint has been made of the impurity of the water for want of circulation, the water has been let off from the ends of pipes, one hundred and forty-four times. In many cases these pipes have been extended and connected with other lines of pipes, remedying this trouble to a great extent.

### Gates.

All needed repairs have been made on the gates the past season, and eighty-eight new ones have been added to the works. In addition to this, considerable expense and trouble have been incurred in raising or lowering the boxes, to conform to the frequent changes in the grades of streets. Six decayed boxes have been taken out and replaced by new ones.

### Hydrants.

The hydrants are in a more satisfactory condition than in any previous year. Forty-five have been added during the year. Owing to laying larger pipes this season and to the removal of many of the small lines of pipes, the supply of water for fire purposes is more ample than it has been heretofore.

### Meters.

Three meters have been applied to the premises of water takers, and three have been removed, making the total number now in use eighty-one. Of this number two are  $\frac{3}{4}$ -inch; seventeen,  $\frac{1}{2}$ -inch; twenty-six, 1-inch; twelve,  $1\frac{1}{2}$ -inch; twenty-two, 2-inch; one, 3-inch; and one, 4-inch size.

### Drinking Fountains.

Three drinking fountains have been added the past season, making the total number fourteen. They are located as follows:—

North Avenue, corner of Walden Street.

Cambridge Common.

Harvard Square, opposite the store of Alfred Wood.

Brattle Square, opposite Brewer's Block.

Atwood's Corner, junction Cambridge and Hampshire Streets.

Cambridge Street, corner Fifth.

Bridge Street, junction of Cambridge

Court Street, between Main Street and Broadway.

Hampshire Street, junction Broadway.

Broadway, corner Norfolk Street.

Lafayette Square, front of Universalist Church.

Haymarket Square, opposite the store of J. A. Holmes & Co.



Haymarket Square, opposite the store of D. U. Chamberlin & Co.  
Fort Washington.

Diameter in inches.	Number of Pipes.	Length in Feet.	TOTALS.	
			Number of Pipes.	Length in Feet.
2	4	713	4	713
1½	4	804	4	804
1¼	4	282	4	282
1	88	796	88	796
¾	881	27,798	881	27,798
Aggregate . . . . .			481	29,848

The total number of supply pipes is . . . . . 5,825



STATEMENT OF LOCATION, SIZE, AND NUMBER OF FEET OF  
PIPE LAID IN 1872.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Avon Hill . . . . .	6	675
Banks . . . . .	6	401
Beaver . . . . .	4	80
Beech . . . . .	4	7
Belmont . . . . .	4	248
Bennett . . . . .	4	419
Blackstone . . . . .	4	127
Bow . . . . .	4	108
Brattle . . . . .	6	205
Brattle . . . . .	4	14
Channing . . . . .	4	281
Cherry . . . . .	4	7
Chestnut . . . . .	4	322
Cogswell . . . . .	8	86
Columbia . . . . .	12	1897
Columbia . . . . .	4	47
Clark . . . . .	8	62
Crane . . . . .	4	98
Dana . . . . .	4	412
Davis . . . . .	4	58
De Wolf . . . . .	4	577
Dexter . . . . .	6	155
Dock . . . . .	6	285
Donnell . . . . .	4	505
Eighth . . . . .	4	7
Eliot . . . . .	4	364
Felton . . . . .	4	300
Fifth . . . . .	4	10
Flagg . . . . .	4	48
Fourth . . . . .	4	13
Franklin . . . . .	4	484
Fremont . . . . .	6	524
Front . . . . .	12	182
Front . . . . .	10	128
Garden . . . . .	6	166
Green . . . . .	4	255
Hampshire . . . . .	4	149
Harrison Avenue . . . . .	4	119
Highland . . . . .	6	342
Inman . . . . .	6	125
Inman . . . . .	4	254
Kent . . . . .	4	258
Kinnaird . . . . .	4	93
Magazine . . . . .	6	105
Main . . . . .	4	25
McCabe . . . . .	4	64
Mead . . . . .	4	222
Mellen . . . . .	4	490
Mount Auburn . . . . .	6	176
Mount Pleasant . . . . .	6	706
New street off Ash . . . . .	4	190
Ninth . . . . .	6	116
North Avenue . . . . .	4	7
Otis . . . . .	4	36
Paper . . . . .	6	85
Parker . . . . .	4	195

STATEMENT OF LOCATION, SIZE, &c. — *Continued.*

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Perry . . . . .	4	142
Pleasant . . . . .	4	8
Plymouth . . . . .	4	705
Potter . . . . .	6	1000
Preston . . . . .	4	360
Putnam Place . . . . .	4	26
Reed . . . . .	6	886
Reed . . . . .	4	6
River . . . . .	6	978
Sands . . . . .	4	161
Second . . . . .	4	12
Soden . . . . .	4	309
South (Somerville) . . . . .	4	120
Spring . . . . .	4	6
Summer . . . . .	6	800
Sidney . . . . .	4	235
Temple . . . . .	4	361
Temple . . . . .	8	12
Thorndike . . . . .	8	2
Tufts . . . . .	4	808
Tuttle . . . . .	6	196
Vine . . . . .	4	355
Walden . . . . .	20	84
Walden . . . . .	8	356
Walden . . . . .	6	465
Wallace . . . . .	4	581
Walnut . . . . .	6	7
Walnut Court . . . . .	8	82
Warland . . . . .	4	188
Washington Avenue . . . . .	6	50
Water . . . . .	4	9
Webster Avenue . . . . .	6	8775
Western Avenue . . . . .	6	391
Western Avenue . . . . .	4	5
Western Avenue . . . . .	8	10
Winthrop . . . . .	4	117
Winthrop . . . . .	8	58

## GATES.

IN WHAT STREET.	Diameter in Inches.	Number.
Avon Hill . . . . .	6	1
Auburn . . . . .	4	1
Banks . . . . .	4	2
Belmont . . . . .	4	1
Blackstone . . . . .	4	1
Brattle . . . . .	12	1
Brattle . . . . .	6	1
Brookline . . . . .	4	1
Cambridge . . . . .	10	1
Cherry . . . . .	4	1
Chestnut . . . . .	4	1

STATEMENT OF LOCATION, SIZE, &c. — *Continued.*

IN WHAT STREET.	Diameter in Inches	Number.
Clark . . . . .	8	1
Columbia . . . . .	12	4
Columbia . . . . .	6	2
Columbia . . . . .	4	3
Columbia . . . . .	8	1
Craigie . . . . .	4	1
Dana . . . . .	4	1
De Wolf . . . . .	4	4
Dock . . . . .	6	1
Donnell . . . . .	4	1
Ehot . . . . .	4	2
Felton . . . . .	4	1
Franklin . . . . .	4	2
Fremont . . . . .	6	2
Front . . . . .	4	1
Hampshire . . . . .	4	2
Kent . . . . .	4	1
McCabe . . . . .	4	1
Mead . . . . .	4	1
Mellen . . . . .	4	1
Mount Auburn . . . . .	4	1
Mount Pleasant . . . . .	6	1
New street off Ash . . . . .	4	1
North Avenue . . . . .	4	1
Osborn . . . . .	4	1
Parker . . . . .	4	1
Perry . . . . .	4	1
Plymouth . . . . .	4	1
Preston . . . . .	4	3
Prospect . . . . .	4	1
Reed . . . . .	6	1
River . . . . .	6	2
Sands . . . . .	4	1
Soden . . . . .	4	1
South . . . . .	4	1
South (Somerville) . . . . .	4	1
Summer . . . . .	6	1
Sidney . . . . .	4	1
Temple . . . . .	4	2
Thorndike . . . . .	8	1
Tufts . . . . .	4	1
Tuttle . . . . .	6	1
Walden . . . . .	20	1
Walden . . . . .	12	1
Walden . . . . .	8	1
Walden . . . . .	6	5
Walden . . . . .	4	1
Walden . . . . . (check valve)	20	1
Warland . . . . .	4	1
Wallace . . . . .	8	1
Walnut . . . . .	6	1
Water . . . . .	6	1
Webster Avenue . . . . .	6	7
Webster Avenue . . . . .	4	5
Western Avenue . . . . .	6	2
Western Avenue . . . . .	3	1
Winthrop . . . . .	4	1
Winthrop . . . . .	3	1

STATEMENT OF LOCATION, SIZE, &c.— Continued.

BLOW-OFF PIPES.

IN WHAT STREET.	Diameter in Inches.	Number.
Channing . . . . .	1½	1
Chestnut . . . . .	1½	2
Felton . . . . .	1½	1
Franklin . . . . .	1½	1
Garden . . . . .	1½	1
Green . . . . .	1½	1
Highland . . . . .	1½	1
Kent . . . . .	1½	1
New street, off Ash . . . . .	1½	1
Parker . . . . .	1½	1
Plymouth . . . . .	1½	1
Preston . . . . .	1½	1
Sands . . . . .	1½	1
Tufts . . . . .	1½	1
Walden . . . . .	1½	1
Walnut Court . . . . .	1½	1
Western Avenue . . . . .	1½	1
WASTE GATES.		
River (at Mill Pond) . . . . .	6	1
Walden (at Vassal Lane) . . . . .	6	1

RECAPITULATION.

84 feet . . . . .	20-inch.
2,079 „ . . . . .	12 „
128 „ . . . . .	10 „
356 „ . . . . .	8 „
12,116 „ . . . . .	6 „
10,862 „ . . . . .	4 „
207 „ . . . . .	8 „

GATES.

2 . . . . .	20-inch.
6 . . . . .	12 „
1 . . . . .	10 „
1 . . . . .	8 „
29 . . . . .	6 „
51 . . . . .	4 „
6 . . . . .	8 „

BLOW-OFF PIPES.

18 . . . . .	1½-inch.
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WASTE GATES.

2 . . . . .	6-inch.
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## STATEMENT

OF STOCK ON HAND EXCLUSIVE OF TOOLS AT PIPE YARD AND SHOP.

14 feet 36-inch pipe.	3 10 × 4-inch T's.
60 feet 24-inch pipe.	4 8 × 8-inch T's.
75 feet 20-inch pipe.	9 8 × 4-inch T's.
36 feet 16-inch pipe.	16 6 × 6-inch T's.
50 feet 12-inch pipe.	12 4 × 4-inch T's.
725 feet 10-inch pipe.	3 3 × 3-inch T's.
2,100 feet 8-inch pipe.	3 12-inch caps.
9,000 feet 6-inch pipe.	11 8-inch caps.
650 feet 4-inch pipe.	2 6-inch caps.
225 feet 3-inch pipe.	6 4-inch caps.
1 20 × 6-inch cross.	2 24-inch sleeves, solid.
1 12 × 12-inch cross.	1 20-inch sleeve, solid.
1 12 × 6-inch cross.	1 16-inch sleeve, solid.
7 12 × 4-inch crosses.	2 12-inch sleeves, solid.
2 8 × 6-inch crosses.	3 10-inch sleeves, solid.
7 8 × 4-inch crosses.	10 8-inch sleeves, solid.
20 6 × 6-inch crosses.	9 6-inch sleeves, solid.
6 6 × 4-inch crosses.	6 4-inch sleeves, solid.
23 4 × 4-inch crosses.	9 3-inch sleeves, solid.
2 3 × 3-inch crosses.	2 24-inch sleeves, clamp.
2 6-inch offsets.	4 12-inch sleeves, clamp.
7 4-inch offsets.	3 10-inch sleeves, clamp.
1 24 × 20-inch T.	3 8-inch sleeves, clamp.
1 24 × 16-inch T.	2 6-inch sleeves, clamp.
1 24 × 12-inch T.	4 4-inch sleeves, clamp.
1 24 × 6-inch T.	3 3-inch sleeves, clamp.
4 20 × 12-inch T's.	1 24 to 10-inch reducer.
3 20 × 6-inch T's.	4 12 to 10-inch reducers.
1 12 × 12-inch T.	2 12 to 8-inch reducers.
1 12 × 8-inch T.	4 10 to 8-inch reducers.
6 12 × 6-inch T's.	7 8 to 6-inch reducers.
2 12 × 4-inch T's.	2 6 to 4-inch reducers.
4 10 × 10-inch T's.	14 4 to 3-inch reducers.
2 10 × 6-inch T's.	4 24-inch $\frac{1}{4}$ -bends.

1 24-inch $\frac{1}{8}$ -bend.	3 8-inch gates.
1 12-inch $\frac{1}{4}$ -bend.	18 6-inch gates.
2 10-inch $\frac{1}{8}$ -bends.	18 4-inch gates.
2 10-inch $\frac{1}{16}$ -bends.	4 3-inch gates.
4 8-inch $\frac{1}{8}$ -bends.	12 large gate-frames and covers.
3 6-inch $\frac{1}{4}$ -bends.	6 small gate-frames and covers.
3 4-inch $\frac{1}{4}$ -bends.	6 large gate-boxes.
1 24-inch gate.	2 small gate-boxes.
1 16-inch gate.	12 hydrant boxes.
2 12-inch gates.	1,000 feet burnettized plank.
5 10-inch gates.	

**Meters.**

4 2-inch Worthington.	2 $\frac{3}{4}$ -inch Navaro.
1 1 $\frac{1}{2}$ -inch Worthington.	2 $\frac{3}{4}$ -inch Ball & Fitts.
6 1-inch Worthington.	2 $\frac{3}{4}$ -inch Harris.
2 1-inch Navaro.	

**Galvanized Pipe.**

200 feet 2-inch.	150 feet 1-inch.
200 feet 1 $\frac{1}{2}$ -inch.	1,000 feet $\frac{3}{4}$ -inch.
300 feet 1 $\frac{1}{4}$ -inch.	

**Fittings for Service Pipe.**

45 2-inch couplings.	14 2-inch elbows.
20 1 $\frac{1}{2}$ -inch couplings.	10 1 $\frac{1}{2}$ -inch elbows.
12 1 $\frac{1}{4}$ -inch couplings.	24 1 $\frac{1}{4}$ -inch elbows.
64 1-inch couplings.	30 1-inch elbows.
75 $\frac{3}{4}$ -inch couplings.	14 $\frac{3}{4}$ -inch elbows.
24 $\frac{3}{4}$ -inch couplings.	30 1-inch street elbows.
94 $\frac{1}{2}$ -inch couplings, right and left.	18 $\frac{3}{4}$ -inch street elbows.
9 1-inch couplings.	4 2-inch nipples.
3 1 $\frac{1}{2}$ -inch plugs.	15 1 $\frac{1}{2}$ -inch nipples.
12 1 $\frac{1}{4}$ -inch plugs.	11 1 $\frac{1}{4}$ -inch nipples.
24 1-inch plugs.	20 1-inch nipples.
36 $\frac{3}{4}$ -inch plugs.	100 $\frac{3}{4}$ -inch nipples.
24 $\frac{1}{2}$ -inch plugs.	6 $\frac{1}{2}$ -inch nipples.
	20 $\frac{3}{8}$ -inch nipples.

12 $\frac{3}{4}$ -inch hose nipples.	10 $\frac{3}{4}$ -inch screw cocks.
5 brass hydrant spindles.	7 $1\frac{1}{2}$ -inch female cocks.
2 2-inch unions.	10 $1\frac{1}{4}$ -inch female cocks.
4 $1\frac{1}{2}$ -inch unions.	23 $\frac{3}{4}$ -inch driving cocks.
18 1-inch unions.	23 $\frac{3}{4}$ -inch corporation cocks.
20 $\frac{3}{4}$ -inch unions.	6 $\frac{3}{4}$ -inch hose bibbs.
50 $\frac{3}{4}$ -inch lock nuts.	36 $\frac{1}{2}$ -inch hose bibbs.
375 socket ends.	12 1-inch air chambers.
10 garden hydrants.	39 $\frac{3}{4}$ -inch air chambers.
17 2-inch T's.	20 $\frac{1}{2}$ -inch air chambers.
21 $1\frac{1}{4}$ -inch T's.	1 cylinder stove.
12 $1\frac{1}{4}$ -inch T's.	4 wagons.
57 1-inch T's.	1 pung.
184 $\frac{3}{4}$ -inch T's.	2 horses.
16 $\frac{1}{2}$ -inch T's.	3 sets harnesses.
3 $1\frac{1}{2}$ -inch crosses.	2 tons old junk.
12 $1\frac{1}{4}$ -inch crosses.	11 wheelbarrows.
12 1-inch crosses.	2 benches.
100 $\frac{3}{4}$ -inch clips.	39 draws for supply fittings.
6 $2 \times 1\frac{1}{2}$ -inch bushings.	35 feet chain.
6 $2 \times 1\frac{1}{4}$ -inch bushings.	7 pairs rubber boots.
12 $2 \times \frac{3}{4}$ -inch bushings.	2 hand carts.
5 $1\frac{1}{2} \times 1$ -inch bushings.	
9 $1\frac{1}{2} \times \frac{3}{4}$ -inch bushings.	2 dwelling-houses.
21 $1\frac{1}{4} \times 1$ -inch bushings.	1 engine-house.
19 $1 \times \frac{3}{4}$ -inch bushings.	1 coal-shed.
19 $\frac{3}{4} \times \frac{1}{2}$ -inch bushings.	
18 1-inch screw cocks.	

## Tools at Pipe Yard and Shop.

1 large hand pump.	5 axes.
50 picks.	7 gate wrenches.
30 shovels.	5 hydrant wrenches.
15 rammers.	6 supply wrenches.
7 crow-bars.	4 blow-off wrenches.
3 paving hammers.	10 monkey wrenches.
4 trowels.	12 pairs tongs.
4 saws.	2 sledge hammers.



1 drilling machine.	3 thawing pumps.
4 hydrant goose necks.	4 furnaces.
3 tool chests.	2 ratchets.
2 bench vises.	1 platform scale.
2 sets caulking tools.	12 lanterns.
7 lump hammers.	1 grindstone.
4 pipe cutters.	1 thawing stove.
3 sets dies.	1 boom derrick.
2 scroll plates and dies.	2 upright derricks.

**Tools at Engine House.**

2 globe lamps.	1 anvil.
3 hand lamps.	8 pairs tongs.
3 lanterns.	15 pairs pipe tongs.
6 lamp chimneys.	2 oil-cups.
1 bench vise.	1 solder iron.
1 hand vise.	2 ladles.
3 files.	1 differential block.
3 screw wrenches.	1 turn buckle.
12 iron wrenches.	1 carpenter's chest.
19 socket wrenches.	2 hand planes.
2 gate wrenches.	3 hand saws.
3 die plates.	1 axe.
2 sets dies.	1 square.
2 sets taps.	1 drawing-knife.
1 ratchet.	2 chisels.
1 breast drill.	8 gouges.
1 drill brace.	3 bitt stocks.
22 drills.	10 bitts.
18 cold chisels.	3 screw-drivers.
10 caulking tools.	1 grindstone.
2 jack screws.	2 paint brushes.
4 crow-bars.	1 set fire tools.
1 sledge.	3 shovels.
1 copper hammer.	1 spade.
1 hand hammer.	3 hoes.
2 coal hammers.	2 rakes.
1 forge.	1 prong hoe.

1 weeder.	2 whitewash brushes.
1 pitchfork.	2 tube brushes.
1 scythe and snath.	4 ladders.
1 iron roller.	1 step ladder.
3 water-pails.	1 steam trap.
1 dust brush.	2 screens.
1 window brush.	2 platform scales.

#### Stock at Engine House.

50 pounds bar iron.	6 gallons kerosene.
50 feet pipe.	20 gallons lard oil.
12 T's.	300 pounds tallow.
36 elbows.	45 sheets rubber.
40 nipples.	19 9-inch rubber valves.
40 couplings.	4 5-inch rubber valves.
4 unions.	50 2½-inch rubber valves.
2 globe valves.	4 36-inch rubber gaskets.
1 pound solder.	2 pairs rubber boots.
30 pounds lead.	20 pounds jute packing.
13 pounds Babbitt metal.	12 pounds hemp packing.
200 pounds bolts and nuts.	6 yards felting.
5 pounds washers.	70 pounds Martin's packing.
9 pounds eye bolts.	50 feet rubber hose.
1 air pump link.	1 coal car.
1 rotary pump.	1 wheelbarrow.
6 valve springs.	2 desks.
4 pounds sheet brass.	10 chairs.
6 pounds screws.	3 spittoons.
20 pounds cut nails.	4 mats.
8 pounds white lead.	564 tons Cumberland coal
5 pounds brown paint.	(2,000 pounds per ton).
10 oil-cans.	3,000 pounds old iron.

A two-story dwelling-house has been built in the Pipe Yard on Auburn Street, and is occupied by one of the teamsters employed on the work at an annual rent of \$150, and stalls have been built in a shed for the two horses employed on the work. The house

has been insured in the Cambridge Mutual Office for \$900, for the term of five years. The insurance on the engineer's dwelling has been renewed in the same office for \$2,500 dollars for five years. There was a dividend to our credit of \$12.

Respectfully submitted.

S. W. DUDLEY,  
*Superintendent.*



City of Cambridge.

THE

NINTH ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL,

TOGETHER WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
AND OTHER DOCUMENTS,

FOR THE YEAR 1873



CAMBRIDGE:

PRESS OF JOHN WILSON AND SON

1874.



City of Cambridge.

THE  
NINTH ANNUAL REPORT  
OF THE

32027

CAMBRIDGE WATER BOARD

TO

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CAMBRIDGE:

PRESS OF JOHN WILSON AND SON.

1874.

★ CAMBRIDGE PUB. LBRY





# REPORT

OF THE

## CAMBRIDGE WATER BOARD.

---

*To the City Council of the City of Cambridge: —*

IN accordance with the requirement of the City Ordinance, the Cambridge Water Board herewith submit their Ninth Annual Report: —

### Cost of the Water Works.

Net cost of the Water Works to Nov. 30, 1872,	
as per our last Report . . . . .	\$1,030,384.86
Expended for extension during the year ending	
Nov. 30, 1873. . . . .	219,030.21
	<hr/>
Making the cost of the Water Works, Nov. 30,	
1873, to be . . . . .	\$1,249,415.07

### Comparative Receipts.

The receipts for water rates for the year ending	
Nov. 30, 1873, were . . . . .	\$146,117.32
The receipts for water rates for the year ending	
Nov. 30, 1872, were . . . . .	127,201.30
	<hr/>
Showing an increase for 1873 of . . . . .	\$18,916.02

Statement in brief, showing the entire transactions on account of the Water Works for the year ending Nov. 30, 1873: —

### Received.

Total appropriations for extension account for the	
year 1873 . . . . .	\$250,000.00
Received from water rates . . . . .	146,117.32
	<hr/>
Amount carried forward . . . . .	\$396,117.32

Amount brought forward . . . . .	\$396,117.32
Received from supply account, and shutting off and letting on water . . . . .	14,834.66
Rent of house, &c. . . . .	157.00
Interest from Sinking Fund to June 30, 1873 . .	8,314.83
Balance of interest from City Treasurer on current account . . . . .	2,195.62
	<u>\$421,619.43</u>

### Expended.

For extension account . . . . .	\$219,030.21
„ care and repair . . . . .	28,002.09
„ supply account . . . . .	18,388.42
„ interest on Water Debt to Nov. 30, 1873 .	65,604.00
„ appropriation transferred to Sinking Fund .	17,827.04
„ appropriation unexpended . . . . .	13,142.75
„ balance showing gain in 1873 . . . . .	59,624.92
	<u>\$421,619.43</u>

By this statement it will be seen that the sum of \$59,624.92 will this year be added to our Sinking Fund, as the result of the year's business; and we congratulate the citizens of Cambridge that so much of the City debt as pertains to the Water Works is in such a fair way of being paid off at no distant day.

The following table will show the rainfall for the past two years, and also the height of the water in the pond:—

	Rainfall 1871-72 Inches.	Rainfall 1872-73 Inches.	Above low- water mark 1871-72 Inches	Above low- water mark 1872-73 Inches
December . . . . .	3 18	8 93	12 8	37
January . . . . .	1 93	5 97	16	43
February . . . . .	2 30	4 04	13	41
March . . . . .	3 09	3 36	15	45 36
April . . . . .	2 68	3 08	27	43
May . . . . .	3 51	4 09	26	36
June . . . . .	4 64	5 0	31	26
July . . . . .	5 17	3 67	26	6 50
August . . . . .	10 97	5 07	35	11 50
September . . . . .	6 67	3 22	44	6
October . . . . .	3 66	4 28	38	3
November . . . . .	4 18	4 89	43	9 50
Total . . . . .	51 98	46 10		

It appears that there were 5.88 inches less rainfall in 1873 than in 1872, and that there were 33.5 inches less water in the pond Nov. 30, 1873, than at the same time in 1872, and giving us in store at the commencement of this year about 167,500,000 gallons less water than we had last year at the same time.

By reference to the Superintendent's Report, it will be seen that we have pumped the past year 775,583,000 gallons, against 593,492,000 gallons the year before, being an excess the present year of 182,091,000 gallons.

The large increase in the amount of water used shows the wisdom of laying our new conduit four feet deeper in the pond, and at the same time shows us the importance of making such connections with the other sources of supply as are necessary to reinforce our present means.

The increase of consumption this year over last is mainly accounted for by good and satisfactory reasons; to wit:—

*First.* We have increased our number of supplies about one thousand, which, at the usual basis of estimate, would add five thousand of population to the number supplied with our water.

*Second.* We have added about four hundred hand-hose, which we have found by experience are large consumers of water, especially in dry times; indeed, during the dry month of June the Board were obliged to restrict the use of garden hose to six hours per day, three hours in the morning and three in the evening; and we were compelled to do this because the water was used so wastefully for irrigation that our pumping power was not sufficient to supply what was needed for domestic and mechanical purposes, with this additional drain upon us. We rejoice at the means to preserve the beauty of our city lawns and gardens during a time of drought; and we think that after our new pump is set, and both in working order, we can supply all the water that is really needful under proper regulations. The last reason we will give is,—

*Third.* We have used about 150,000 gallons per day over any former year in watering the streets. This use of the water has added very much to the attractiveness of our city, and the comfort of our citizens, and any others whose business or pleasure has brought them into our midst; and we do not think it will be the fault of this Department if all our main streets are not kept well watered, believing that in this economy and comfort meet together.

### Work Commenced.

The work which was under contract at the beginning of the year, as set forth in our last Report, has been steadily prosecuted up to this time; and while, for reasons beyond our control, we are not as far along with some portions of our work as we expected we should be at this time when we made our last Report, yet we have the satisfaction of now reporting that the new engine-house is nearly completed. The new boilers are set, and at this time good progress is being made in setting up the new pumping-engine. The grading around the engine-house is being done, and all the work which was commenced is fast approaching completion.

### New Main Pipe Laid.

During the year we have laid a new main pipe, of twenty inches diameter, from Walden Street, at Concord Turnpike, near the reservoir, down to Third Street in East Cambridge, a distance of about three miles. This will supply two great needs. *First*, by furnishing a large supply of water with increased pressure to the extreme portion of our city, and where many of our largest customers are located. *Second*, by the various connections made on the route it will reinforce and in a large degree duplicate the supply of water in other parts of the city.

We have also laid a new thirty-inch pumping main from the new engine-house to the reservoir; and in laying it preparations have been made for the use of a third pump whenever that may become necessary, by providing for the necessary connections therewith. By the laying of these new main pipes, our works, when the new pump is completed, will be duplicated throughout; and we think provision has thus been made for an ample supply of water for present wants in all parts of the city.

### Extension Account.

The expenditures the past year for extension account have been unusually large; but they have all been in the line of *permanent improvements*, the benefits of which will extend over many years. It has been our design in all that has been done that it should be a part of a comprehensive plan, which, when completed, will give us



as good a system of water supply as can be found where the water is forced up to give a head for distribution.

There are several things yet to do before the plan will be complete. The principal things are as follows : —

1st. The connection of Little and Spy Ponds with Fresh Pond, so as to make available all the present sources of our water supply, and thus provide as far as we can against the possibility of a water famine.

2d. The thorough cleaning out of the shallow portions of Fresh Pond, where there are large quantities of vegetable matter deposited which is exposed to the sun every year during the time of low water, resulting in a fermentation of decayed matter, which cannot fail to contaminate our water. Our attention has been frequently called to this subject by some of our best citizens ; and we think the time has come when the importance of the subject calls for our early attention and action.

3d. The laying of another main supply pipe, coming down Brattle or Mount Auburn Streets to Brattle Square, thence down Main Street to Third Street, with a branch leading through Putnam Avenue, and other connecting streets, coming around into the main pipe again near the Universalist Church on Main Street.

4th. The ultimate extension of the sewer already commenced entirely around Fresh Pond, so as to cut off all filthy drainage into the Pond. This kind of drainage is constantly increasing as the regions around become more settled, and will soon demand serious attention.

While it is desirable to have every thing needed done at once, it is not our judgment that the city should be at the expense of doing too many things at one time, but should gradually finish the works, doing that which is the most needed first, and so on to the end.

It is our intention during the coming year to move our present large engine and boilers over to the new engine-house ; and, when this is done, it will be necessary to have the engine put in complete repair, to the end that we may have two pumps in the best possible condition. When this is done, we do not anticipate any large expenses in connection with the pumping department for several years.

For what we deemed good reasons, we have in our last two Annual

Reports made recommendations that the City Council should apply to the Legislature for certain additional rights ; for some reason to us unknown no action has been taken in the matter. The importance of the right to erect tide-gates on Alewife Brook, and to shut out the fish, has come to be almost absolutely necessary ; and we do therefore again repeat the request that action be taken in this matter at the earliest moment. We can only feel, after having strongly pressed this matter upon your attention so many times, that in this our active duty in it ceases, and all further responsibility rests with the City Council. We recommend the City Council to make application to the Legislature as follows : —

*First.* For leave to erect tide-gates at North Avenue on Alewife Brook, to shut out the fish from going above that point, and for right to raise the pond above high-water mark for storage purposes.

*Second.* That the City of Cambridge be granted the right to make and execute police regulations for the borders of Fresh Pond, in whatever town or city it may lie.

*Third.* That we be permitted to take water from such streams as can be conveniently brought to reinforce our present water supply, where by so doing we shall not interfere with any rights already granted to others.

The petition sent to you that a fence be put around the reservoir as a protection against accidents (one nearly fatal having just then occurred by a young person falling in), and which petition was referred to this Board, was duly considered by us ; and it was determined to comply with the request. A contract was made for a suitable iron fence, and we are informed that it is nearly ready to be put up. We find that the beauty of the location, and the magnificent scenery from the reservoir, invite more and more visitors every year. This addition, making it a safe resort for children, will, no doubt, add still more to its popularity as a place of resort for health and pleasure.

At the proper time we intend to ask you for an appropriation which will enable us the ensuing year to make the following improvements : —

1st. To clean out the borders of Fresh Pond.

2d. To connect Fresh, Little, and Spy Ponds by a suitable conduit.



3d. To clean out Alewife Brook, and erect tide-gates (if the right is granted) thereon.

As we do not anticipate laying any large main pipes the coming year, it will be a good time to do this work on the plan of gradually doing what is necessary to complete the Water Works, aside from the fact that this work should be done at once on account of its importance.

For the details of the work done, and present condition of the Water Works, we would refer you to the Reports of the Registrar and Superintendent herewith submitted.

In closing our Report, it is our pleasure to repeat the testimony of former years as to the general faithfulness of those employed by this Board.

Respectfully submitted.

C. W. KINGSLEY,  
H. L. EUSTIS,  
J. WARREN MERRILL,  
SAMUEL SLOCOMB,  
GEORGE P. CARTER,  
ISAAC BRADFORD,  
F. H. WHITMAN,

} *Cambridge  
Water Board.*

*December 6, 1873.*

# REPORT

OF

## THE WATER REGISTRAR.

---

WATER REGISTRAR'S OFFICE, }  
CAMBRIDGE, Dec 1, 1873. }

*To the Cambridge Water Board:—*

GENTLEMEN, — The Water Registrar hereby respectfully submits his Report for the year ending Nov. 30, 1873, as required by an ordinance of the City.

### Receipts.

Water rates . . . . .	\$146,117.32
Service pipe, laying and repairing . . . . .	14,524.66
Rent of house, Pipe Yard . . . . .	157.00
Fines, off and on water . . . . .	310.00
Total . . . . .	\$161,108.98

All of which has been paid into the City Treasury.

The increased amount of income for the financial

year over the previous year is . . . . . \$19,357.29

### Expenditures.

The expenditures for the care and management of the Works for the year ending Nov. 30, 1873, have been as follows:—

For care and repairs . . . . .	\$9,447.74
For pumping service . . . . .	12,980.41
For office expenses . . . . .	5,573.94
Total amount . . . . .	\$28,002.09

The expenditures on the extension of the Works for  
 the year ending Nov. 30, 1873, were . . . . \$219,030.21  
 The expenditure on supply account was . . . . 18,388.42

The following table exhibits the yearly revenue received from  
 water rates, since the purchase of the Works by the City : —

From April 28, 1865, to Dec. 1, 1865	. . . .	\$32,367.19
„ Dec. 1, 1865, „ 1866	. . . .	40,073.27
„ „ 1866, „ 1867	. . . .	52,733.62
„ „ 1867, „ 1868	. . . .	63,747.42
„ „ 1868, „ 1869	. . . .	76,149.30
„ „ 1869, „ 1870	. . . .	92,606.95
„ „ 1870, „ 1871	. . . .	111,782.65
„ „ 1871, „ 1872	. . . .	127,201.30
„ „ 1872, „ 1873	. . . .	146,117.32
		<hr/>
		\$742,779.02

The water has been shut off from the premises of water takers  
 for non-payment of rates, one hundred and seventy times. Of  
 this number one hundred and fifty-five have been let on, leaving a  
 balance of fifteen still remaining off.

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, &c., SUP-  
 PLIED WITH FRESH POND WATER TO DEC. 1, 1873.

8856 Families.  
 1070 Hand Hose.  
 651 Private Stables.  
 212 Stores.  
 77 Stationary Engines.  
 48 Saloons.  
 41 Offices.  
 29 School-houses.  
 29 Boarding Houses.  
 27 Meat Markets.  
 24 Barber Shops.

- 18 Blacksmith Shops.
- 17 Bake-houses.
- 17 Greenhouses.
- 15 College Buildings.
- 14 Soap Manufactories.
- 11 Livery Stables.
- 11 Churches.
- 11 Glass Works.
- 10 Machine Shops.
- 10 Public Halls.
- 9 Fish Markets.
- 9 Billiard Halls.
- 9 Lodging Houses.
- 8 Furniture Manufactories.
- 8 Horse Railroad Stables.
- 8 Lumber Wharves.
- 7 Club Rooms.
- 7 Banks.
- 7 Public Houses.
- 7 Cow Pastures.
- 6 Printing Offices.
- 6 Carpenters' Shops.
- 6 Coal Wharves.
- 6 Stone Yards.
- 5 Police Stations.
- 5 Carriage Manufactories.
- 5 Paint Shops.
- 5 Iron Foundries.
- 5 Harness Shops.
- 5 Marble Works.
- 5 Planing Mills.
- 5 Nurseries.
- 5 Plumber Shops.
- 4 Confectionery Manufactories.
- 4 Book Binderies.
- 4 Photograph Rooms.
- 4 Engine Houses.
- 4 Slaughter Houses.

- 4 Cooper Shops.
- 4 Post Offices.
- 3 Cigar Manufactories.
- 3 Steam Railroad Depots.
- 3 Steam Railroads.
- 3 Box Manufactories.
- 2 Organ Factories.
- 2 Tin Ware Manufactories.
- 2 Club Stables.
- 2 Bacon Works.
- 2 Tallow Factories.
- 2 Private Schools.
- 2 Brush Manufactories.
- 2 Laboratories.
- 2 I. O. of O. F. Halls.
- 2 Masonic Halls.
- 2 City Stables.
- 2 Aquariums.
- 2 Libraries.
- 2 Stereotype Foundries.
- 2 Boiler Manufactories.
- 2 Laundries.
- 2 Spring Bed Manufactories.
- 2 Sausage Manufactories.
- 2 Potteries.
- 1 Cider Refinery.
- 1 Chemical Works.
- 1 Ice Tool Manufactory.
- 1 Coffin Manufactory.
- 1 Fruit Preserving Company.
- 1 Cattle Yard.
- 1 Almshouse.
- 1 Brass Foundry.
- 1 Brewery.
- 1 Botanic Garden.
- 1 Brick Yard.
- 1 Currier Shop.
- 1 Color Manufactory.

- 1 City Hall.
- 1 K. of P. Hall.
- 1 City Wharf.
- 1 Cemetery.
- 1 Drain Pipe Manufactory.
- 1 Distillery.
- 1 G. A. R. Hall.
- 1 Gas Works. .
- 1 Gymnasium.
- 1 House of Correction.
- 1 Lead Pipe Works.
- 1 Lard Works.
- 1 Museum of Comparative Zoölogy.
- 1 Lobster House.
- 1 Lard Factory.
- 1 Ice Company.
- 1 Hardware Manufactory.
- 1 Paper Collar Manufactory.
- 1 Rolling Mill.
- 1 Sugar Refinery.
- 1 Swine Yard.
- 1 Grapery.
- 1 Bleachery.
- 1 Car Wheel Company.
- 1 Frame and Moulding Manufactory.
- 1 Oiled Hat and Clothing Manufactory.
- 1 Shoe Manufactory.
- 1 Milk Shed.
- 1 Freight Depot.
- 1 Conservatory of Music.

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## STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE  
PREMISES OF WATER TAKERS IN THE CITY OF CAMBRIDGE, DEC 1, 1872

- 10051 Faucets.
- 2542 Water Closets.
- 2522 Wash Bowls.

- 1410 Bath Tubs.  
 1252 Wash Tubs.  
 321 Slop Closets.  
 85 Garden Hydrants for Hand Hose.  
 78 Yard Hydrants for Family Use.  
 6 Tumbler Washers.  
 16 Private Fountains.

During the year, six meters have been applied, and three removed from the premises of water takers, making the total number now in use eighty-four. They are attached to a variety of manufacturing establishments as follows:—

WHERE ATTACHED.	SIZE OF METERS.					
	$\frac{1}{2}$ in.	$\frac{3}{4}$ in.	1 in.	1 $\frac{1}{2}$ in.	2 in.	4 in.
A. H. Hews & Co.					1	
Bullard & Scott				1		
Botanic Garden			1			
Bay State Glass Co.					1	
Batchelder, Moore, & Co.				1		
Braman, Shaw, & Co.				1		
Boston and Albany R. R. Co.					1	
Boston and Lowell R. R. Co.			1		3	1
Boston Chemical Works					1	
Boston Rolling Mill					1	
Boston Stamping and Manufacturing Co.			1			
Boston Car Wheel Co.		1				
Beal & Hooper					1	
B. P. Clark & Co.			1			
Bay State Color Co.					1	
C. L. Jones			1			
C. B. French			1			
Cambridge Gas Light Co.		1				
Cambridge Stamping Co.	1	1				
C. H. North & Co.					1	
Curtis Davis				1		
Doe & Hunnewell				1		
Edgar L. Kinsley					1	
Fitchburg R. R. Co.					1	
Francis Draper & Co.		1				
F. Geldowsky				1		
George Woods & Co.				1		
House of Correction					1	
H. O. Houghton & Co.			1			
Henry Thayer & Co.					1	
Hancock & Greely				1		
H. M. Clark		1				
Holyoke House					1	
John Conlan			1			
John P. Squire & Co.		1			1	
John Wilson & Son			1			
James D. Osborn					1	
John Beardon & Sons			1			
J. J. Gray			1			



WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{1}{4}$ in.	$\frac{1}{2}$ in.	1 in.	1 $\frac{1}{2}$ in.	2 in.	3 in.	4 in.
James C. Davis . . . . .	.	.	1	.	.	.	.
James Lee . . . . .	.	.	1	.	.	.	.
Leonard Cox . . . . .	.	1	.	.	.	.	.
Little & Brown . . . . .	.	.	1	.	.	.	.
Mt. Auburn Cemetery . . . . .	.	.	.	1	1	.	.
Mason & Hamlin . . . . .	.	.	1	.	.	.	.
Middlesex Bleachery . . . . .	.	1	.	.	.	.	.
New England Glass Co. . . . .	.	.	.	.	1	.	.
New England Brick Co. . . . .	.	.	.	.	2	.	.
O. S. Bullock . . . . .	.	.	1	.	.	.	.
Prospect House . . . . .	.	.	.	1	.	.	.
Revere Sugar Refinery . . . . .	.	.	.	.	1	.	.
Reversible Collar Co. . . . .	.	.	.	.	1	.	.
Shawmut Iron Works . . . . .	.	1	.	.	.	.	.
Sylvester Tower . . . . .	.	.	1	.	.	.	.
Sortwell & Co. . . . .	.	.	.	.	1	.	.
S. M. Coffran . . . . .	.	.	.	.	1	.	.
St. Mary's Church . . . . .	.	.	.	.	1	.	.
Thayer Club . . . . .	.	1	.	.	.	.	.
T. S. Huckins . . . . .	.	.	1	.	.	.	.
Theodore Downing . . . . .	.	.	1	.	.	.	.
Union Glass Co. . . . .	.	1	2	.	.	.	.
Union Railway Co. . . . .	.	5	2	2	1	.	.
Woodbury & Co. . . . .	.	.	.	.	1	.	.
Welch, Bigelow, & Co. . . . .	.	1	.	.	.	.	.
Whittemore & Hale . . . . .	.	.	2	.	.	.	.

The annual inspection of all buildings supplied with Fresh Pond water has been made as required by the City ordinance, and a very few slight leaks only were discovered. The fixtures throughout the city are believed to be in more complete repair than in any former year.

Respectfully submitted.

A. F. FIFIELD,

*Water Registrar.*

# REPORT

CONCERNING

## THE ACCOUNTS OF THE WATER REGISTRAR.

---

IN CAMBRIDGE WATER BOARD, }  
December, 1878.

THE Committee appointed to examine the accounts of the Water Registrar for the financial year ending Nov. 30, 1873, herewith submit the following

### REPORT:

Your Committee have examined the books and accounts of the Water Registrar, and compared them with the vouchers, and find that the same are correct.

Respectfully submitted.

SAMUEL SLOCOMB, }  
GEO. P. CARTER, } *Committee.*

# REPORT

## OF THE

### SUPERINTENDENT OF THE WATER WORKS.

---

*To the Cambridge Water Board:—*

GENTLEMEN, — The fiscal year of 1873 having expired on the 30th day of November, the Superintendent of the Cambridge Water Works very respectfully presents to your Honorable Board his Annual Report for that year, it being the ninth year of the control of the Works by the City. In making this Report, I experience much pleasure in being able to inform you that the Works in my charge continue in a highly prosperous and satisfactory condition. No very serious damage has occurred in any of the branches of the work, with the exception of some unimportant breakages on lines of the oldest and smallest pipes. The active management of the Works remains unchanged, the same officers occupying the positions they have filled for many years.

#### Engine House.

We are now pumping the water consumed in the City with one of H. R. Worthington's Duplex Pumping Engines, of a daily capacity of 5,000,000 gallons. Size of steam cylinder, 21 inches for high pressure, and  $36\frac{1}{2}$  inches for low pressure, with a four-foot stroke. Size of water cylinder, 32 inches. Speed of engine, 47 strokes per minute. Amount of water discharged at each stroke, say 300 gallons. The only reserve pumping power that we have at present consists of two old style Worthington pump-engines, put in during the year 1856. The help required at pumping works consists of one engineer, one assistant, and two

firemen. There were 775,583,000 gallons of water pumped the last year, consuming 1,535,400 pounds of coal; this includes banking fires. The average number of gallons pumped daily was 2,124,884. The pumping time for the ten months of the year while using our large pump was 3,159 hours 15 minutes, being a daily average of 10 hours 25 minutes.

### Pond.

The water in the pond is of the very best quality; and I think all complaints that have been made in regard to the water can be traced directly to the large amount of vegetable matter which has been deposited in the shallow part of the pond. If this was removed, we should have the purest water of any city in the vicinity, and no doubt satisfactory to all our consumers for domestic or manufacturing purposes. The gates at the outlet on Alewife Brook have been closed, to prevent the drainage of the meadows from flowing into the pond, with the exception of the time required by the laws of the State for them to be kept open, to allow the fish to pass in and out.

The following table shows the height of the water in the pond at the end of each month of the year:—

December . . . . .	17	inches below the highest point known.
January . . . . .	11	" " " " " "
February . . . . .	13	" " " " " "
March . . . . .	8½	" " " " " "
April . . . . .	11	" " " " " "
May . . . . .	18	" " " " " "
June . . . . .	28	" " " " " "
July . . . . .	47½	" " " " " "
August . . . . .	42½	" " " " " "
September . . . . .	48	" " " " " "
October . . . . .	51	" " " " " "
November . . . . .	44½	" " " " " "

### Force Main.

The 24-inch force main is in good condition; only a few slight leaks have occurred on it during the year. A new 30-inch force main has been laid the present season, leading from the new engine-house to the reservoir, and will be ready for use when the new works are completed.

### Reservoir and Stand-Pipe.

The small reservoir has been thoroughly cleaned out, and a new copper strainer has been placed on the 16-inch outlet. The walls around both reservoirs have been repaired and blue-washed, and are now in good condition. A cap has been placed on the top of the stand-pipe, which will answer for an air-chamber to afford a higher pressure on the distribution pipes, with a gauge to ascertain the pressure used. The height of the stand-pipe above marsh level at the overflow is 120 feet, and of the reservoir 77 feet.

### Distribution Pipes.

About  $8\frac{1}{2}$  miles of pipe have been laid the present season, making the total length of pipe in the city at the present time about  $80\frac{1}{2}$  miles.

A new six-inch pipe has been laid in Washington Street, and the old four-inch has been abandoned. This was found to be necessary on account of the filling up of this district, which left the old pipe twelve feet below the surface of the ground, occasioning a great many leaks which were difficult to get at and repair. In Austin Street a six-inch pipe has been laid, and the three-inch pipe removed. This was very much needed for a better supply of water for fire purposes.

### Gates.

All the gates have been examined, and packed to prevent freezing, and 86 new ones have been added to the Works. Six decayed boxes have been removed and replaced by new ones.

### Hydrants.

Thirty-three old pattern flush hydrants have been set the present season. Under an order of the City Council, thirty-three post hydrants have been set this year, with the three set the previous year making a total of thirty-six post hydrants. The post hydrants are more satisfactory than the old pattern hydrants, and have each two outlets, yielding a better supply of water for fire purposes.

### Meters.

Six meters have been applied to the premises of water takers, and three have been removed, making the total number now in use eighty-four.



**Drinking Fountains.**

One drinking fountain has been added the past season, making the total number fifteen. They are located as follows : —

North Avenue, corner of Walden Street.

Cambridge Common.

Harvard Square, opposite the store of Alfred Wood.

Brattle Square, opposite Brewer's Block.

Atwood's Corner, junction Cambridge and Hampshire Streets.

Cambridge Street, corner Fifth.

Bridge Street, junction of Cambridge.

Third Street, between Main Street and Broadway.

Hampshire Street, junction Broadway.

Broadway, corner Norfolk Street.

Lafayette Square, front of Universalist Church.

Central Square, opposite the store of J. A. Holmes & Co.

Central Square, opposite the store of D. U. Chamberlin & Co.

Fort Washington.

Putnam Avenue, corner Pearl.

Two stone drinking-troughs have been presented to the City this year : one by Thomas H. Brewer, Esq., which is located in Brattle Square ; the other by D. H. Thurston, Esq., which is located in East Cambridge, in the square at the junction of Cambridge and Bridge Streets. These have proved themselves to be a great public convenience. We hope there will be other public-spirited citizens who will follow their example.

**Stand Pipes for Street Watering.**

Twenty-one upright stand-pipes encased in a cast-iron barrel, with a valve at the top and a swing arm to fill water-carts, have been erected the present season, and are located as follows : —

Main Street, west of Quincy Street.

North Avenue, near the Common.

„ „ „ Forest Street.

„ „ „ Beech Street.

„ „ „ Day Street.

Concord Avenue, junction Garden.

Near University Press.

Inman, near Broadway.

Broadway, corner Winsor Street.

Columbia Street.

Green, near Western Avenue.

Cambridge, at Atwood's Corner.

Cambridge Street, 20 feet west of Warren.

Gore Street, opposite School-house.

Otis Street, near Third.

Junction Bridge and Cambridge Streets.

Fifth Street, near Thorndike.

North Avenue, near Shepard.

Dana, corner Chatham Street.

Brattle, corner Sparks Street.

Broadway, corner Sixth.

Dublin Street, near Fitchburg Railroad, for filling locomotives that run on the track.

These have been of great convenience. They are of capacity to deliver 500 gallons in four minutes, being a great saving of time and water over the old method of drawing water from the flush hydrants. There is also another advantage, as they are more easily kept in order, and can in emergency be used for the extinguishment of fires.

### Service Pipes.

Diameter in inches.	Number of Pipes.	Length in Feet.	TOTALS.	
			Number of Pipes.	Length in Feet.
2	57	1,187	57	1,187
1½	12	1,012	12	1,012
1½	8	775	8	775
1	53	1,585	53	1,585
¾	864	29,982	864	29,982
Aggregate . . . . .			494	34,541

The total number of supply pipes is 5,819.

About 6½ miles of supply pipe have been laid the present season.



STATEMENT OF LOCATION, SIZE, AND NUMBER OF FEET OF  
PIPE LAID IN 1873.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Athens . . . . .	4	86
Austin . . . . .	6	1,857
Banks . . . . .	6	280
Banks . . . . .	4	60
Bennett . . . . .	4	48
Boardman . . . . .	4	168
Brewery . . . . .	4	192
Central Square . . . . .	4	20
Chestnut . . . . .	4	510
Church . . . . .	6	742
Clay . . . . .	6	181
Cogswell Avenue . . . . .	4	12
Concord Avenue . . . . .	6	22
Concord Avenue and Cambridge Street (cement) . . . . .	20	15,728
Crescent . . . . .	6	26
Crescent . . . . .	4	641
Crescent Avenue . . . . .	6	142
Dublin . . . . .	12	2,728
Dublin . . . . .	4	80
Earl . . . . .	4	288
Ellery . . . . .	4	10
Elmer . . . . .	4	480
Fairfield . . . . .	4	850
Fairmont . . . . .	4	184
First . . . . .	8	166
Florence . . . . .	4	64
Follen . . . . .	4	134
Foster . . . . .	4	407
Fourth . . . . .	4	115
Frank . . . . .	4	416
Fardner . . . . .	4	290
Freem . . . . .	4	114
Lamilton . . . . .	4	221
Harvard . . . . .	4	40
Hollis . . . . .	6	798
Houghton . . . . .	6	285
Hubbard Avenue . . . . .	6	819
Human . . . . .	4	30
Jay . . . . .	4	123
Lambert Avenue . . . . .	6	60
Langdon . . . . .	4	170
Laurel . . . . .	4	148
Meacham . . . . .	4	444
Montgomery . . . . .	4	72
Mount Auburn . . . . .	4	16
Murray . . . . .	4	908
Murdock . . . . .	4	168
North Avenue . . . . .	6	72
North Avenue . . . . .	4	12
North Avenue . . . . .	8	280
Norton . . . . .	4	210

STATEMENT OF LOCATION, SIZE, &c. — *Continued.*

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Oxford . . . . .	4	12
Otis . . . . .	4	160
Pearl . . . . .	4	50
Pine . . . . .	4	120
Plymouth . . . . .	4	238
Preston . . . . .	4	273
Pumping Main . . . . .	20	1,900
Putnam Avenue . . . . .	4	288
Putnam Place . . . . .	4	368
Raymond . . . . .	6	305
Rice . . . . .	6	488
Sacramento Court . . . . .	4	255
Sands . . . . .	4	253
School . . . . .	4	■
Seventh . . . . .	■	2-8
Shawmut Avenue . . . . .	6	210
Short . . . . .	4	229
Sixth . . . . .	4	118
Somerset . . . . .	4	175
South . . . . .	4	■
Spruce . . . . .	10	700
Spruce . . . . .	■	170
Thorndike . . . . .	6	700
Thorndike . . . . .	3	300
Walden . . . . .	20	2,700
Walden . . . . .	8	1,676
Walden . . . . .	4	12
Walnut Court . . . . .	3	47
Washington . . . . .	6	1,110
Western Avenue . . . . .	4	303
White . . . . .	■	480
Winsor . . . . .	6	478

## GATES.

IN WHAT STREET.	Diameter in Inches.	Number
Athens . . . . .	4	1
Austin . . . . .	6	4
Austin . . . . .	4	2
Austin . . . . .	8	1
Banks . . . . .	6	1
Brewery . . . . .	4	2
Cambridge . . . . .	■	1
Cambridge . . . . .	10	1
Cambridge Common . . . . .	■	2
Cambridge Common . . . . .	6	1
Cement Pipe . . . . .	20	4
Cement Pipe . . . . .	10	4
Cement Pipe . . . . .	8	4
Cement Pipe . . . . .	6	4

STATEMENT OF LOCATION, SIZE, &c.— *Continued.*

IN WHAT STREET.	Diameter in Inches.	Number.
Central Square . . . . .	4	1
Chestnut . . . . .	4	8
Church . . . . .	6	2
Clay . . . . .	6	1
Concord Avenue . . . . .	20	2
Concord Avenue . . . . .	10	2
Concord Avenue . . . . .	6	6
Crescent . . . . .	6	1
Crescent . . . . .	4	1
Crescent Avenue . . . . .	6	1
Dublin . . . . .	6	12
Earl . . . . .	4	1
Elmer . . . . .	4	1
Fairfield . . . . .	4	1
Fairmont . . . . .	4	1
First . . . . .	8	2
Foster . . . . .	4	1
Fourth . . . . .	4	1
Frank . . . . .	4	1
Gardner . . . . .	4	2
Green . . . . .	4	1
Hamilton . . . . .	4	2
Harvard . . . . .	4	1
Hollis . . . . .	6	2
Houghton . . . . .	6	1
Hubbard Avenue . . . . .	6	1
Hy . . . . .	4	1
Lurel . . . . .	4	1
Leacham . . . . .	4	1
Mount Auburn . . . . .	4	1
Murdock . . . . .	4	1
North Avenue . . . . .	4	1
Orton . . . . .	4	1
Paris . . . . .	4	1
Pine . . . . .	4	1
Potter . . . . .	6	1
Pumping Main . . . . .	30	1
Putnam Place . . . . .	4	1
Raymond . . . . .	6	1
Rice . . . . .	6	1
Sacramento Court . . . . .	4	1
School . . . . .	4	1
Seventh . . . . .	4	1
Short . . . . .	4	1
Sixth . . . . .	4	1
Somerset . . . . .	4	1
Spruce . . . . .	6	1
Thorndike . . . . .	6	2
Thorndike . . . . .	4	1
Valden . . . . .	20	1
Valden . . . . .	8	1
Washington . . . . .	6	2
Western Avenue . . . . .	4	1
Winsor . . . . .	6	1
Winsor . . . . .	4	1

## WATER WORKS.

## STATEMENT OF LOCATION, SIZE, &amp;c. — Continued.

## BLOW-OFF PIPES.

IN WHAT STREET.	Diameter in inches.	Number
Boardman . . . . .	1½	1
Chestnut . . . . .	1½	1
Crescent . . . . .	1½	1
Crescent Avenue . . . . .	1½	1
Earl . . . . .	1½	1
Elmer . . . . .	1½	1
Meacham . . . . .	1½	1
Montgomery . . . . .	1½	1
Plymouth . . . . .	1½	1
Putnam Place . . . . .	1½	1
Thorndike . . . . .	1½	1
Walnut Court . . . . .	1½	1
White . . . . .	1½	1

## RECAPITULATION.

1,000 feet . . . . .	30-inch.
21,128 " . . . . .	20 "
28 " . . . . .	12 "
700 " . . . . .	10 "
1,826 " . . . . .	8 "
8,847 " . . . . .	6 "
10,751 " . . . . .	4 "
748 " . . . . .	3 "

## GATES.

1 . . . . .	30-inch.
10 . . . . .	20 "
7 . . . . .	10 "
5 . . . . .	8 "
46 . . . . .	6 "
42 . . . . .	4 "
4 . . . . .	3 "

## BLOW-OFF PIPES.

18 . . . . .	1½ "
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## STATEMENT

OF STOCK ON HAND EXCLUSIVE OF TOOLS AT SHOP.

## Galvanized Pipe.

100 feet 2-inch.	400 feet $\frac{3}{4}$ -inch.
100 feet $1\frac{1}{2}$ -inch.	100 feet $\frac{1}{2}$ -inch.
100 feet $1\frac{1}{4}$ -inch.	300 feet $\frac{3}{4}$ -inch, coated.
100 feet 1-inch.	

## Fittings for Service Pipes.

7 1-inch hose bibbs.	50 $2 \times 1$ -inch T's.
7 $\frac{1}{2}$ -inch hose bibbs.	40 $1\frac{1}{2}$ -inch T's.
3 $\frac{1}{2}$ -inch compression bibbs.	50 $1\frac{1}{2} \times 1\frac{1}{4}$ -inch T's.
3 $\frac{1}{4}$ -inch compression bibbs.	40 $1\frac{1}{2} \times 1$ -inch T's.
3 $1\frac{1}{4}$ -inch screw cocks.	40 $1\frac{1}{2} \times \frac{3}{4}$ -inch T's.
3 1-inch screw cocks.	90 $1\frac{1}{4}$ -inch T's.
3 $\frac{1}{2}$ -inch screw cocks.	50 $1\frac{1}{4} \times 1$ -inch T's.
3 M. & F. cocks for 20-inch cement pipe.	38 $1\frac{1}{4} \times \frac{3}{4}$ -inch T's.
3 2-inch cock.	80 1-inch T's.
1 $\frac{1}{2}$ -inch cocks.	80 $1 \times \frac{3}{4}$ -inch T's.
1 $\frac{1}{4}$ -inch cocks.	450 $\frac{3}{4}$ -inch T's.
1 1-inch cocks.	300 $\frac{3}{4} \times \frac{1}{2}$ -inch T's.
1 1-inch stop and wastes.	55 $\frac{1}{2}$ -inch T's.
1 $\frac{3}{4}$ -inch stop and wastes.	40 2-inch elbows.
1 $\frac{3}{4}$ -inch hose nipples.	80 $1\frac{1}{2}$ -inch elbows.
1 solder nipples and unions for lead pipe.	90 $1\frac{1}{4}$ -inch elbows.
1 garden hydrant stop and wastes.	150 1-inch elbows.
1 fire hydrant stop and wastes.	225 $\frac{3}{4}$ -inch elbows.
1 $1\frac{1}{2}$ -inch corporation cocks.	77 $\frac{1}{2}$ -inch elbows.
1 $\frac{1}{4}$ -inch corporation cocks.	100 2-inch couplings.
10 2-inch T's.	150 $1\frac{1}{2}$ -inch couplings.
2 $2 \times 1\frac{1}{2}$ -inch T's.	100 $1\frac{1}{4}$ -inch couplings.
2 $2 \times 1\frac{1}{4}$ -inch T's.	190 1-inch couplings.
	120 $\frac{3}{4}$ -inch couplings.
	400 $\frac{1}{2}$ -inch couplings.
	100 1-inch air chambers.

400  $\frac{3}{4}$ -inch air chambers.  
 100  $\frac{1}{2}$ -inch air chambers.  
 68 1-inch street elbows.  
 250 1-inch street elbows.  
 23 2-inch crosses.  
 10  $2 \times 1\frac{1}{2}$ -inch crosses.  
 2  $2 \times 1\frac{1}{4}$ -inch crosses.  
 15  $2 \times 1$ -inch crosses.  
 13  $1\frac{1}{2} \times 1\frac{1}{4}$ -inch crosses.  
 40  $1\frac{1}{2} \times 1$ -inch crosses.  
 40  $1\frac{1}{2} \times \frac{3}{4}$ -inch crosses.  
 40  $1\frac{1}{2}$ -inch crosses.  
 50  $1\frac{1}{4}$ -inch crosses.  
 25  $1\frac{1}{4} \times 1$ -inch crosses.  
 25  $1\frac{1}{4} \times \frac{3}{4}$ -inch crosses.  
 18 1-inch crosses.  
 25  $1 \times \frac{3}{4}$ -inch crosses.  
 20  $\frac{3}{4}$ -inch crosses.  
 1 garden hydrant.  
 134  $\frac{3}{4}$ -inch socket ends.  
 150 1-inch clips.  
 800  $\frac{3}{4}$ -inch clips.  
 150  $\frac{1}{2}$ -inch clips.  
 30 2-inch unions.  
 50  $1\frac{1}{2}$ -inch unions.  
 50  $1\frac{1}{4}$ -inch unions.

35 1-inch unions.  
 35  $\frac{3}{4}$ -inch unions.  
 20 2-inch nipples.  
 100  $1\frac{1}{2}$ -inch nipples.  
 100  $1\frac{1}{4}$ -inch nipples.  
 50 1-inch nipples.  
 230  $\frac{3}{4}$ -inch nipples.  
 400  $\frac{1}{2}$ -inch nipples.  
 12  $1\frac{1}{2}$ -inch plugs.  
 20  $1\frac{1}{4}$ -inch plugs.  
 80 1-inch plugs.  
 100  $\frac{3}{4}$ -inch plugs.  
 50  $\frac{1}{2}$ -inch plugs.  
 24  $2 \times 1\frac{1}{2}$ -inch bushings.  
 24  $2 \times 1\frac{1}{4}$ -inch bushings.  
 17  $2 \times 1$ -inch bushings.  
 24  $2 \times \frac{3}{4}$ -inch bushings.  
 24  $1\frac{1}{2} \times 1\frac{1}{4}$ -inch bushings.  
 24  $1\frac{1}{2} \times \frac{3}{4}$ -inch bushings.  
 24  $1\frac{1}{4} \times 1$ -inch bushings.  
 24  $1\frac{1}{4} \times \frac{3}{4}$ -inch bushings.  
 40  $\frac{3}{4} \times \frac{1}{2}$ -inch bushings.  
 100 1-inch lock nuts.  
 150  $\frac{3}{4}$ -inch lock nuts.  
 50  $\frac{1}{2}$ -inch lock nuts.

#### Miscellaneous.

4 wagons.  
 2 hand carts.  
 2 horses.  
 3 sets harnesses.  
 1 pung.  
 1 cylinder stove.  
 1 boom derrick.  
 2 upright derricks.  
 1 thawing stone.  
 1 grindstone.  
 1 platform scale.

2 bench vises.  
 1 tool chest.  
 1 large hand pump.  
 12 lanterns.  
 6 wheelbarrows.  
 35 feet chain.  
 1 dwelling-house at yard.  
 1 dwelling-house at pond.  
 1 engine-house        "  
 1 coal-shed            "

**Tools.**

plates and dies.	3 axes.
scroll plates.	3 sledge hammers.
pipe cutters.	3 thawing pumps.
drilling machines.	8 lump hammers.
ratchets.	3 sets caulking tools.
1 pair tongs.	6 gate wrenches.
pipe wrenches.	3 hydrant wrenches.
monkey wrenches.	4 blow-off wrenches.
pipe vises for hand carts.	3 supply wrenches.
1 picks.	4 hydrant goose necks.
10 shovels.	4 furnaces.
5 rammers.	15 stone drills.
crow-bars.	1 spirit level.
paving hammers.	5 bundles packing.
trowels.	2 tons lead.
saws.	

**Tools at Engine House.**

globe lamps.	2 jack screws.
lanterns.	4 crow-bars.
lamp chimneys.	1 sledge.
bench vise.	1 copper hammer.
hand vise.	1 hand hammer.
screw wrenches.	2 coal hammers.
iron wrenches.	1 forge.
socket wrenches.	1 anvil.
gate wrenches.	8 pairs tongs.
die plates.	15 pairs pipe tongs.
sets dies.	1 solder iron.
sets taps.	2 ladles.
ratchet.	1 differential block.
breast drill.	1 turn buckle.
drill brace.	1 carpenter's chest.
1 drills.	2 hand planes.
1 cold chisels.	3 hand saws.
1 caulking tools.	1 axe.



1 square.  
 1 drawing-knife.  
 1 chisel.  
 8 gouges.  
 2 bitt stocks.  
 10 bitts.  
 8 screw-drivers.  
 1 grindstone.  
 1 set fire tools.  
 8 shovels.  
 1 spade.

1 rake.  
 1 prong hoe.  
 1 scythe and snath.  
 1 iron roller.  
 8 water-pails.  
 2 whitewash brushes.  
 4 ladders.  
 1 step ladder.  
 1 steam trap.  
 2 screens.  
 2 platform scales.

### Stock at Engine House.

20 pounds bar iron.  
 80 feet pipe.  
 12 T's.  
 36 elbows.  
 40 nipples.  
 40 couplings.  
 4 unions.  
 30 pounds lead.  
 13 pounds Babbitt metal.  
 200 pounds bolts and nuts.  
 5 pounds washers.  
 9 pounds eye bolts.  
 1 rotary pump.  
 6 valve springs.  
 4 pounds sheet brass.  
 6 pounds screws.  
 10 pounds cut nails.  
 10 oil-cans.  
 3 gallons kerosene.

30 gallons lard oil.  
 50 pounds tallow.  
 30 pounds sheet rubber.  
 15 9-inch rubber valves.  
 4 5-inch rubber valves.  
 50 2½-inch rubber valves.  
 4 36-inch rubber gaskets.  
 2 pairs rubber boots.  
 20 pounds jute packing.  
 12 pounds hemp packing.  
 70 pounds Martin's packing  
 1 coal car.  
 1 wheelbarrow.  
 2 desks.  
 3 spittoons.  
 560 tons Cumberland  
 (2,000 pounds per ton).  
 3,000 pounds old iron.

## Stock at Pipe Yard.

2 24-inch sleeves.	4 lengths 3-inch pipe, 12 feet to a length.
2 20-inch sleeves.	1 12 × 12-inch cross.
4 12-inch sleeves.	2 12 × 6-inch crosses.
2 10-inch sleeves.	3 8 × 4-inch crosses.
2 8-inch sleeves.	4 6 × 6-inch crosses.
24 6-inch sleeves.	10 6 × 4-inch crosses.
18 4-inch sleeves.	20 4 × 4-inch crosses.
4 3-inch sleeves.	1 3 × 3-inch cross.
2 24-inch sleeves, clamp.	2 24 × 24-inch T's.
4 12-inch sleeves, clamp.	1 24 × 12-inch T.
3 10-inch sleeves, clamp.	1 20 × 20-inch T.
2 8-inch sleeves, clamp.	3 20 × 12-inch T's.
1 6-inch sleeves, clamp.	1 12 × 12-inch T.
3 4-inch sleeves, clamp.	1 12 × 10-inch T.
3 3-inch sleeves, clamp.	3 12 × 6-inch T's.
24 6-inch double offsets.	1 10 × 10-inch T.
4 12-inch caps.	2 10 × 6-inch T's.
14 8-inch caps.	8 8 × 8-inch T's.
8 6-inch caps.	4 8 × 4-inch T's.
2 4-inch caps.	3 6 × 6-inch T's.
29 lengths 30-inch pipe, 12 ft. to a length.	18 6 × 4-inch T's.
5 lengths 24-inch pipe, 12 ft. to a length.	24 4 × 4-inch T's.
3 lengths 20-inch pipe, 12 ft. to a length.	2 $\frac{1}{8}$ 20-inch bends.
10 lengths 12-inch pipe, 12 ft. to a length.	1 $\frac{1}{8}$ 10-inch bend.
10 lengths 10-inch pipe, 12 ft. to a length.	1 $\frac{1}{8}$ 8-inch bend.
19 lengths 8-inch pipe, 12 ft. to a length.	34 $\frac{1}{8}$ 6-inch bends.
840 lengths 6-inch pipe, 12 ft. to a length.	2 $\frac{1}{16}$ 24-inch bends.
30 lengths 4-inch pipe, 12 feet to a length.	1 12 × 12-inch reducer.
	2 12 × 10-inch reducers.
	3 10 × 8-inch reducers.
	2 10 × 6-inch reducers.
	9 6 × 4-inch reducers.
	9 4 × 3-inch reducers.
	4 6-inch offsets.
	15 4-inch offsets.



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City of Cambridge.

32026

THE

TENTH ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL,

TOGETHER WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
AND OTHER DOCUMENTS,

FOR THE YEAR 1874



CAMBRIDGE:

PRESS OF JOHN WILSON AND SON.

1875.





City of Cambridge.

GEORGE

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★ CAMBRIDGE PUB. LBRY



## **CAMBRIDGE WATER BOARD.**

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**ISAAC BRADFORD, *Mayer, ex officio.***

**GEORGE F. PIPER, *Pres. Common Council, ex officio.***

**GEORGE P. CARTER.**

**HENRY L. EUSTIS.**

**CHESTER W. KINGSLEY.**

**J. WARREN MERRILL.**

**SAMUEL SLOCOMB.**

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*President,*

**CHESTER W. KINGSLEY.**

*Clerk,*

**JUSTIN A. JACOBS.**

*Water Registrar,*

**ABIEL F. FIFIELD.**

*Superintendent,*

**SAMUEL W. DUDLEY.**

# REPORT

## OF THE

### CAMBRIDGE WATER BOARD.

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*To the City Council of the City of Cambridge: —*

In compliance with the duty imposed upon them by the City Ordinance, the Cambridge Water Board herewith make to you their Tenth Annual Report.

#### Cost of the Water Works.

Net cost of the Water Works Nov. 30, 1873, as	
per last year's Report . . . . .	\$1,249,415.07
Expended for extension during the year ending	
Nov. 30, 1874 . . . . .	149,981.46
Making total cost Nov. 30, 1874 . . . . .	<u>\$1,399,396.53</u>

#### Comparative Receipts.

Receipts for water rates for the year ending Nov.	
30, 1874 . . . . .	\$153,634.27
Receipts for water rates for the year ending Nov.	
30, 1873 . . . . .	146,117.32
Showing increase for the year . . . . .	<u>\$7,516.95</u>
In addition to this there is due to the Water	
Department from the City: —	
Bills of 1873, as rendered . . . . .	\$5,271.29
„ „ 1874, „ „ . . . . .	6,804.60
	<u>12,075.89</u>
Which if added would make the increase 1874 .	<u>\$19,592.84</u>

Statement showing the entire transactions in brief on the Water Works for the year ending Nov. 30, 1874 : —

**Received.**

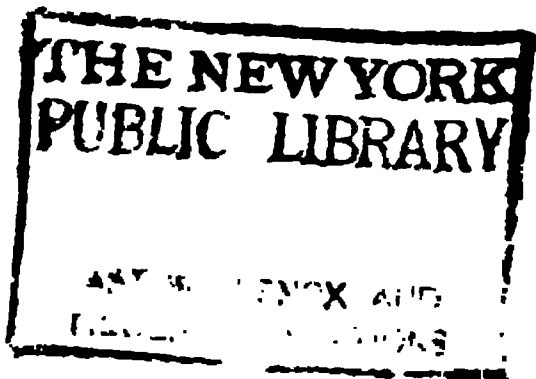
Amount of appropriation for extension . . . . .	\$154
From water rates . . . . .	158
From supply account and shutting off and letting on the water . . . . .	16
From rent of house . . . . .	
„ interest on the Sinking Fund to June 30 . . . . .	13
„ „ on current account . . . . .	2
„ accrued interest on Water Bonds (sold) . . . . .	4
	<hr/>
	\$340

**Expended.**

For extension account . . . . .	\$149
„ care and repair . . . . .	29
„ supply account . . . . .	18
„ interest on Water Debt to June 30, 1874 . . . . .	73
„ unexpended appropriation . . . . .	
Balance showing gain in 1874 . . . . .	74
	<hr/>
	\$340

We are happy to be able to show the Water Works in financial condition, notwithstanding the amount already expended and the need there will be of expending more to complete the work so well begun ; yet, if left undisturbed, in due time all the debt will be paid, while supplying our citizens with excellent water at a moderate price, and without imposing a burden upon any class.

We present to you a table showing the comparative cost of water and also the height of water in the pond as compared with the water mark, during the years 1873 and 1874, ending November 30 in each year.



THE NEW YORK  
PUBLIC LIBRARY

ASTOR, LENOX, AND  
TILDEN FOUNDATIONS.

	Rainfall, 1873. Inches.	Rainfall 1874. Inches.	Below high- water mark. 1873. Inches.	Below high- water mark 1874 Inches.
er . . . . .	8.98	4.64	16	86.62
. . . . .	5.97	3.28	10	21.82
7 . . . . .	4.04	4.42	12	24.37
. . . . .	3.36	1.49	7.64	29
. . . . .	3.08	0.39	10	27.25
. . . . .	4.09	3.50	17	20.88
. . . . .	.50	3.87	■	23.50
. . . . .	3.67	2.54	46.50	33.75
. . . . .	5.07	6.82	41.50	35.37
er . . . . .	3.22	1.52	47	45.38
. . . . .	4.28	1.07	50	54
er . . . . .	4.89	2.33	43.50	59.62
. . . . .	46.10	41.87		

From this table it will be seen that there were 4.23 inches less in 1874 than in 1873, and that there were 16.12 inches less in the pond Nov. 30, 1874, than at the same time in 1873, or at 5,000,000 gallons per inch, 80,600,000 gallons less in the end of this year than there were last year at the same time and 248,100,000 gallons less than we had at the same time before last.

In reference to the Superintendent's Report, we find that we had, in 1874, 839,188,100 gallons, while in 1873 we pumped 780,000 gallons, being an excess this year of 63,605,100 gallons, which is satisfactorily accounted for by the increased number of water-takers, and the larger amount taken for watering the

### Work Completed.

During the past year a large amount of work which was under way at the commencement of the season has been finished, of which, as most prominent, we may name the following

1. The new main pipe passing through Concord Avenue from Cambridge Street to East Cambridge, which gives to that part of the City an abundant supply for all purposes, and with a head of water.

2. The new pumping-engine house has been completed,



and the land around it filled and graded. Connected with it is an ample boiler-house and coal-sheds, all arranged in a most convenient manner, and calculated for three Worthington pumps, two of which we have now; and the third, when needed, may be of a capacity equal to both of our present pumps, ample room for which has been provided.

*Third.* The new 5,000,000 gallon duplex pumping-engine which was under contract to be built for us by H. R. Worthington Esq., with its boilers connected, has been completed, and set up in the new building, where it has been successfully at work for the past three months, supplying the City with water.

*Fourth.* The new conduit into the pond connecting with the well-rooms in the new engine-house is done, and has been in use since the new pump was started. The new conduit is laid more than four feet lower than the old one, and is carried out into much deeper water.

*Fifth.* A new iron fence has been built around the Reservoir as a matter of safety; at the same time it adds very much to the beauty of the place, which is becoming more and more a place of resort for our citizens.

Thus it will be seen that much of the work which was in progress at the beginning of the year has been completed, and is now in working order. We may now look at some of the

### **New Work Done.**

As soon as our new pump was at work, we had our old pump taken down, sent to New York, and thoroughly repaired, made to conform in appearance with the new pump; and it is now being set up again in the new house. The old boilers have also been taken down, repaired, moved, and set up in the new boiler-house, and are all ready for work. The work of setting up the old pump will be completed in a few weeks, when we shall have two of Worthington's 5,000,000 gallon duplex pumps, both in the best possible condition, either of which will supply the City under ordinary circumstances. It is not expected that it will be necessary to run both pumps at the same time, except a few hours per day at

such times in the year as the consumption is greatest, or in case of an extra demand for fire purposes.

When our present pumping facilities are completed, which will be very soon, we can for the first time say that our *Water Works are duplicated throughout*; and no reasonable fear need be entertained of any failure in our supply of water on account of the inadequacy of our pumping power.

#### **New Main Pipe Laid.**

At the beginning of the year, among other things we asked an appropriation for connecting Fresh, Little, and Spy Ponds by a suitable conduit, and also for cleaning out the borders of the pond, where large quantities of vegetable matter have accumulated, contaminating the water, and exceedingly unsightly to look upon. During the earlier months of the year we had abundant rains, as you will see by the rainfall table. The water in the pond reached its highest point in May, and we were led to think that it was going to be a wet season, and unfavorable for doing the work we had laid out of connecting the ponds. We therefore looked round for the next most important work to be done in our Department. In that part of the City bounded by Pleasant, Main, and Mount Auburn Streets and the river, there was a very poor and inadequate supply of water for fire purposes, as the pipes were all small, while the territory described is thickly settled with wooden buildings. Our attention was called to this matter by both the Mayor and the Chief Engineer of the Fire Department. As the price of iron pipe was very low, we decided to apply the money which had been intended to connect the ponds towards laying a large main pipe through that section of the City, where it was so much needed. We therefore laid a 20-inch pipe from Holmes Place, on North Avenue, to the corner of Mount Auburn and Brighton Streets; thence a 24-inch pipe through Mount Auburn Street and Putnam Avenue to Green Street; thence a 16-inch pipe continuing in Putnam Avenue to Pleasant Street, where it connects with a cross main pipe from Cambridge Street, which is already laid. This work is a part of the plan adopted by the Board several years ago for piping the City.

**New Work Recommended.**

The result has proved that we were mistaken in the character of the season, as our pond has settled several inches lower than any record we have of it, and warns us that we cannot longer safely defer the work of connecting the ponds. Another important consideration, besides the scarcity of water, showing that this work should be done at once, is this: The City has turned several sewers into Alewife Brook, one of them near the outlet of the pond. It is also proposed to erect tide-gates on the brook, to prevent the tide from floating the sewerage up to the pond and over the meadows. After the brook is dredged out, what is wanted is a constant stream running out of Fresh Pond all the time through Alewife Brook, to carry down and away the sewerage in the brook. We think by connecting the ponds this can be accomplished, by making the waters of the other ponds run through and out of Fresh Pond whenever the same are in good condition for use.

The unprecedented low price of iron pipe, and the abundance of labor, lead us to think that it will be sound policy to extend still further some of the large main pipes in pursuance of the plan we have already referred to. We would recommend the coming year, 1st, to continue the pipe in Putnam Avenue to Sidney Street; 2d, a main pipe through Green Street to Sidney Street; thence through Sidney to Front Street and Main Street, connecting with the Columbia Street pipe; thence down Main Street to Portland Street, where we connect with another cross main pipe from Cambridge Street and Broadway.

We shall therefore at the proper time ask you for an appropriation on extension account, to enable us the ensuing year to do the following work:—

*First.* To connect Fresh, Little, and Spy Ponds by a suitable conduit, to make available the water supplied from those sources.

*Second.* To clean out the borders of Fresh Pond near our pumping works, where the bottom of the pond becomes exposed at low water.

*Third.* To lay some more main pipes, as hereinbefore more fully set forth.

*Fourth.* To provide suitable buildings to accommodate our engineers and firemen, those whom we are obliged to employ about the Works all the time, and who should be on the ground, where their services can be commanded at all times, night and day.

We recommend that application be made to the Legislature that the maximum of the Water Loan be increased from \$1,500,000 to \$2,000,000.

For the details of what has been done in the ordinary prosecution of the work connected with the Water Works, and for the present condition of the property and accounts connected therewith, we would refer you to the Reports of the Registrar and Superintendent herewith submitted.

It seems proper that we should here mention the interest taken by Jacob Hittinger, Esq., who owns a very large part of the land bordering on Fresh Pond, and who at no small expense keeps the borders of the pond opposite his land well cleaned out, in this respect setting for us an example well worth our following.

C. W. KINGSLEY,	}	<i>Cambridge Water Board.</i>
J. WARREN MERRILL,		
SAMUEL SLOCOMB,		
GEO. P. CARTER,		
H. L. EUSTIS,		

**REPORT**  
**OF**  
**THE WATER REGISTRAR.**

---

WATER REGISTRAR'S OFFICE, }  
CAMBRIDGE, Dec. 1, 1874. }

*To the Cambridge Water Board: —*

GENTLEMEN, — As required by an Ordinance of the City, my Annual Report for the year ending Nov. 30, 1874, is respectfully presented, showing a statement of the receipts and expenditures for the year, and such other matters in the Department as are deemed important.

**Receipts.**

Water rates . . . . .	\$153,634.27
Supply pipe, laying and repairing . . . . .	15,491.60
Fines, off and on water . . . . .	513.00
Rent of house, Pipe Yard . . . . .	150.00
Sale of old junk . . . . .	11.00
Sale of oil barrel . . . . .	1.25
Total . . . . .	<u>\$169,801.12</u>

All of which has been paid to the City Treasurer.  
The increased amount of income for the financial  
year over the previous year is . . . . . \$8,692.14

**Expenditures.**

The expenditures for the care and management of the Works  
for the year ending Nov. 30, 1874, have been as follows: —

For care and repairs . . . . .	\$9,286.40
For pumping service . . . . .	14,218.65
For office expenses . . . . .	5,986.15
<b>Total amount . . . . .</b>	<b>\$29,491.20</b>

The large expenditure for pumping service includes a year's supply of coal now on hand.

The expenditures on the extension of the Works for

the year ending Nov. 30, 1874, were . . . . \$149,981.46

The expenditure on supply account was . . . . 13,349.23

Statement of the yearly revenue received from water rates, since the purchase of the Works by the City : —

From April 28, 1865, to Dec. 1, 1865 . . . .	\$32,367.19
„ Dec. 1, 1865, „ 1866 . . . .	40,073.27
„ „ 1866, „ 1867 . . . .	52,733.62
„ „ 1867, „ 1868 . . . .	63,747.42
„ „ 1868, „ 1869 . . . .	76,149.30
„ „ 1869, „ 1870 . . . .	92,606.95
„ „ 1870, „ 1871 . . . .	111,782.65
„ „ 1871, „ 1872 . . . .	127,201.30
„ „ 1872, „ 1873 . . . .	146,117.32
„ „ 1873, „ 1874 . . . .	153,634.27
<b>Total . . . . .</b>	<b>\$896,413.29</b>

In the last Report there were remaining off for non-

payment of rates . . . . .	15
Since shut off . . . . .	248
	<hr/> 263
Let on . . . . .	250
	<hr/> 13
Still remaining off . . . . .	

There are at the present time one hundred and seven vacant houses in the City, for which no rate has been collected. The water has been shut off from these premises, so far as it could be done without interfering with parties connected with the same pipes who have paid their rates.







25	Boarding Houses.
21	Blacksmith Shops.
17	Bake-houses.
16	College Buildings.
16	Soap Manufactories.
14	Green-houses.
14	Public Halls.
12	Livery Stables.
12	Churches.
11	Fish Markets.
9	Billiard Halls.
9	Lodging Houses.
9	Coal Wharves.
8	Horse Railroad Stables.
8	Club Rooms.
8	Banks.
7	Machine Shops.
7	Furniture Manufactories.
6	Lumber Wharves.
6	Cow Pastures.
6	Stone Yards.
6	Marble Works.
6	Engine Houses.
5	Carpenters' Shops.
5	Police Stations.
5	Harness Shops.
5	Planing Mills.
5	Nurseries.
5	Carriage Manufactories.
5	Plumber Shops.
5	Bacon Works.
4	Public Houses.
4	Paint Shops.
4	Iron Foundries.
4	Book Binderies.
4	Photograph Rooms.
4	Slaughter Houses.

- 4 Cooper Shops.
- 4 Post-offices.
- 3 Printing Offices.
- 3 Cigar Manufactories.
- 3 Steam Railroad Depots.
- 3 Steam Railroads.
- 3 Box Manufactories.
- 3 I. O. O. F. Halls.
- 3 Aquariums.
- 3 Lard Works.
- 2 Glass Works.
- 2 Confectionery Manufactories.
- 2 Organ Factories.
- 2 Tin Ware Manufactories.
- 2 Club Stables.
- 2 Tallow Factories.
- 2 Private Schools.
- 2 Laboratories.
- 2 Masonic Halls.
- 2 City Stables.
- 2 Libraries.
- 2 Stereotype Foundries.
- 2 Boiler Manufactories.
- 2 Laundries.
- 2 Spring Bed Manufactories.
- 2 Sausage Manufactories.
- 2 Potteries.
- 1 Brush Manufactory.
- 1 Cider Refinery.
- 1 Chemical Works.
- 1 Ice Tool Manufactory.
- 1 Coffin Manufactory.
- 1 Fruit Preserving Company.
- 1 Cattle Yard.
- 1 Almshouse.
- 1 Brass Foundry.
- 1 Botanic Garden.

- 1 Brick Yard.
- 1 Currier Shop.
- 1 City Hall.
- 1 K. of P. Hall.
- 1 City Wharf.
- 1 Cemetery.
- 1 Drain Pipe Manufactory.
- 1 Distillery.
- 1 G. A. R. Hall.
- 1 Gas Works.
- 1 Gymnasium.
- 1 House of Correction.
- 1 Lead Pipe Works.
- 1 Museum of Comparative Zoölogy.
- 1 Lobster House.
- 1 Last Factory.
- 1 Ice Company.
- 1 Hardware Manufactory.
- 1 Paper Collar Manufactory.
- 1 Rolling Mill.
- 1 Sugar Refinery.
- 1 Swine Yard.
- 1 Grapery.
- 1 Bleachery.
- 1 Car Wheel Company.
- 1 Frame and Moulding Manufactory.
- 1 Oiled Hat and Clothing Manufactory.
- 1 Shoe Manufactory.
- 1 Milk Shed.
- 1 Freight Depot.
- 1 Conservatory of Music.

## STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES  
OF WATER TAKERS IN THE CITY OF CAMBRIDGE, DEC. 1, 1874.

11,834	Faucets.
2,909	Water Closets.
2,664	Wash Bowls.
1,511	Bath Tubs.
1,335	Wash Tubs.
441	Slop Closets.
88	Garden Hydrants for Hand Hose.
78	Yard Hydrants for Family Use.
13	Private Fountains.
9	Tumbler Washers.

During the year, six meters have been applied, and six removed from the premises of water takers, making the total number now in use eighty-four. They are attached to a variety of manufacturing establishments, as follows:—

WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{3}{4}$ in.	$\frac{1}{2}$ in.	1 in.	1 $\frac{1}{2}$ in.	2 in.	3 in.	4 in.
A. H. Hews & Co . . . . .	.	.	.	1	1	.	.
Bulard & Scott . . . . .	.	.	.	1	.	.	.
Botanic Garden . . . . .	.	.	1	.	.	.	.
Braman, Shaw, & Co. . . . .	.	.	.	1	.	.	.
Boston & Albany R. R. Co. . . . .	.	.	.	.	1	.	.
Boston & Lowell R. R. Co. . . . .	.	.	1	.	1	.	1
Boston Chemical Works . . . . .	.	.	.	.	1	.	.
Boston Rolling Mill . . . . .	.	.	.	.	1	.	.
Boston Stamping Manufacturing Co. . . . .	.	.	1	.	.	.	.
Boston Car Wheel Co. . . . .	.	1	.	.	.	.	.
Beal & Hooper . . . . .	.	.	.	.	1	.	.
B. P. Clark & Co. . . . .	.	.	.	1	.	.	.
City of Cambridge . . . . .	.	.	.	.	1	.	.
C. L. Jones . . . . .	.	.	1	.	.	.	.
C. B. French . . . . .	.	.	1	.	.	.	.
Cambridge Gas Light Co. . . . .	.	1	.	.	.	.	.
Cambridge Stamping Co. . . . .	1	1	.	.	.	.	.
C. H. North & Co. . . . .	.	.	.	.	1	.	.
Curtis Davis . . . . .	.	.	.	1	.	.	.
D. G. Pratt . . . . .	.	.	1	.	.	.	.
Doe & Hunnewell . . . . .	.	.	.	1	.	.	.
Edgar L. Kinsley . . . . .	.	.	.	.	1	.	.
Fitchburg R. R. Co. . . . .	.	.	.	.	1	.	.
Francis Draper & Co. . . . .	.	1	.	.	.	.	.
F. Geldowsky . . . . .	.	.	.	1	.	.	1
G. G. Page & Co. . . . .	.	.	.	.	1	.	.

WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{1}{8}$ in.	$\frac{3}{8}$ in.	1 in.	1 $\frac{1}{2}$ in.	2 in.	3 in.	4 in.
George Woods & Co. . . . .	.	.	.	1	.	.	.
George O. Ladd & Co. . . . .	.	.	1	.	.	.	.
House of Correction . . . . .	.	.	.	.	1	.	.
H. O. Houghton & Co. . . . .	.	.	1	.	.	.	.
Henry Thayer & Co. . . . .	.	.	.	.	1	.	.
Hancock & Greely . . . . .	.	.	.	1	.	.	.
H. M. Clark . . . . .	.	1	.	.	.	.	.
Holyoke House . . . . .	.	.	.	.	1	.	.
J. P. Squire & Co. . . . .	.	1	.	.	1	.	.
John Wilson & Son . . . . .	.	.	1	.	.	.	.
James D. Osborn . . . . .	.	.	.	.	1	.	.
John Reardon & Sons . . . . .	.	.	1	.	.	.	.
J. J. Gray . . . . .	.	.	1	.	.	.	.
James C. Davis . . . . .	.	.	1	.	.	.	.
Leonard Cox . . . . .	.	1	.	.	.	.	.
Little, Brown, & Co. . . . .	.	.	1	.	.	.	.
Low & Knight . . . . .	.	.	.	1	.	.	.
Mt. Auburn Cemetery . . . . .	.	.	.	1	1	.	.
Mason & Hamlin . . . . .	.	.	1	.	.	.	.
Middlesex Bleachery . . . . .	.	1	.	.	.	.	.
Memorial Hall . . . . .	.	.	.	.	1	.	.
New England Glass Co. . . . .	.	.	.	.	1	.	.
New England Brick Co. . . . .	.	.	.	.	2	.	.
O. S. Bullock . . . . .	.	.	1	.	.	.	.
Oleomargarine Factory . . . . .	.	1	.	.	.	.	.
Prospect House . . . . .	.	.	.	1	.	.	.
Revere Sugar Refinery . . . . .	.	.	.	.	1	.	.
Reversible Collar Co. . . . .	.	.	.	.	1	.	.
Sylvester Tower . . . . .	.	.	1	.	.	.	.
Sortwell & Co. . . . .	.	.	.	.	1	.	.
S. M. Cofran . . . . .	.	.	.	.	1	.	.
St. Mary's Church . . . . .	.	.	.	.	1	.	.
Theodore Downing . . . . .	.	.	1	.	.	.	.
Union Glass Co. . . . .	.	1	2	.	.	.	.
Union Railway Co. . . . .	.	4	1	2	8	.	.
Woodbury & Co. . . . .	.	.	.	.	1	.	.
Welch, Bigelow, & Co. . . . .	.	1	.	.	.	.	.
Whittemore & Hale . . . . .	.	.	2	.	.	.	.
Walworth Manufacturing Co. . . . .	.	.	.	1	.	.	.

The annual inspection of all water fixtures has been made as required by the City Ordinance. In all places where waste was discovered, it has been stopped, and all leaky fixtures have been repaired.

Respectfully submitted.

A. F. FIFIELD,

*Water Registrar.*

# REPORT

CONCERNING

THE ACCOUNTS OF THE WATER REGISTRAR.

---

IN CAMBRIDGE WATER BOARD,  
Jan. 29, 1875.

}

THE Auditing Committee appointed on the accounts of the  
Water Registrar for the financial year ending Nov. 30, 1874,  
herewith submit the following

## REPORT:

. That they have examined the vouchers, books, and accounts of  
the Water Registrar, and find that the same are correct.

Respectfully submitted.

GEO. P. CARTER,  
SAMUEL SLOCOMB, } *Committee*

# REPORT

## OF THE

### SUPERINTENDENT OF THE WATER WORKS.

---

*To the President of the Cambridge Water Board:—*

DEAR SIR,—I have the honor to present the Ninth Annual Report to the Water Board as required by the City Ordinance concerning the Water Works of the City of Cambridge and the use of Fresh Pond water.

#### Pond.

The pond has been severely taxed the past summer, partly on account of the large amount of water used for watering streets, which consumed about a fourth part of the water pumped for a period of seven months, together with the addition of new takers and the long-continued drought of the season, which has reduced the water about ten inches below the lowest point ever before observed, which has afforded a good opportunity to remove, as far as possible, the vegetation within the border of the pond.

#### Engine House.

On the 14th of August the new pump in the new pumping building was started. This pump is connected with the new 48-inch conduit, which extends into the pond where there is 25 feet depth of water, enabling us to pump purer water, and is laid 5 feet below the old one, which has been removed, as it was partly out of water. Had we been obliged to depend on the old conduit for a supply of water for our well-room, we could not possibly have supplied the City this summer.



### **Force Main.**

A 30-inch force main has been laid from the new pumping-house to the reservoir, which duplicates our entire pumping facilities. We have now, to supply the City with water, two Duplex Worthington Pumping Engines, of a daily capacity of 5,000,000 gallons each.

### **Reservoir.**

The outer wall on the Walden Street side has been slightly disturbed by frost, and may soon have to be repaired. The banks and grass slopes are in excellent condition; and an iron fence has been erected on the inside stone coping around the reservoir, to prevent accident to children and visitors, and to keep dogs from swimming in the water. ●

### **Distribution Pipes.**

Quite a number of small pipes have been taken up the present season, and pipes of larger sizes laid instead. These pipes have been laid by the day instead of by contract, as they are all short lines, where parties have petitioned for a supply of water, and subscribed the rates required by the Water Board. We have been compelled to change the location of a number of lines of pipe at a large expense, where they came in the way of sewers in progress of building. Permanent men are employed to make all repairs and put in all service-pipes from the street main to cellars of buildings, in accordance with the regulation of the Water Board.

### **Hydrants.**

A large proportion of hydrants are of the old flush pattern. Since the request of the City Council was made, in the summer of 1873, none but post hydrants have been put in. The Board has adopted the Boston Machine Co.'s pattern. We have been very successful with them, owing to the good and careful management of the Fire Department. That they are the best hydrants yet invented there is no doubt; and the best proof of their superiority is the adoption of them by the Chief Engineer of the Fire Depart-

ment, after a very careful investigation of the merits of all kinds now in use in the country. All hydrants are in good working order, and continue to receive our close attention.

#### Drinking Fountains.

The drinking fountain in Harvard Square has been removed, and one of a different pattern substituted, making the total number fifteen. They are located as follows: —

North Avenue, corner of Walden Street.

Cambridge Common.

Harvard Square, opposite the store of Alfred Wood.

Brattle Square, opposite Brewer's Block.

Atwood's Corner, junction Cambridge and Hampshire Streets.

Cambridge Street, corner Fifth Street.

Bridge Street, junction of Cambridge Street.

Third Street, between Main Street and Broadway.

Hampshire Street, junction Broadway.

Broadway, corner Norfolk Street.

Lafayette Square, front of Universalist Church.

Central Square, opposite the store of J. A. Holmes & Co.

Central Square, opposite the store of D. U. Chamberlin & Co.

Fort Washington.

Putnam Avenue, corner Pearl Street.

#### Stand-Pipes for Street Watering.

Twelve stand-pipes for street watering have been erected the present season, making the total number now in use thirty-three, located as follows: —

Main Street, west of Quincy Street.

North Avenue, near the Common.

„ „ „ Forest Street.

„ „ „ Beech Street.

„ „ „ Day Street.

Concord Avenue, junction Garden Street.

Near University Press.

Inman Street, near Broadway.

Broadway, corner Winsor Street.

Columbia Street, near Austin Street.

Green Street, near Western Avenue.  
 Cambridge Street, at Atwood's Corner.  
 Cambridge Street, near Warren Street.  
 Gore Street, opposite School-house.  
 Otis Street, near Third Street.  
 Junction Bridge and Cambridge Streets.  
 Fifth Street, near Thorndike Street.  
 North Avenue, near Shepard Street.  
 Dana Street, corner Chatham Street.  
 Brattle Street, corner Sparks Street.  
 Broadway, corner Sixth Street.  
 Dublin Street, near Fitchburg Railroad, for filling locomotives  
 that run on track.  
 Broadway, near Third Street.  
 Western Avenue, near Howard Street.  
 Third Street, near Rogers Street.  
 Main Street, near Portland Street.  
 Magazine Street, opposite Warland Street.  
 Main Street, near Hancock Street.  
 Kirkland Street, near Quincy Street.  
 Brattle Street, near Fayerweather Street.  
 Brattle Street, near Fresh Pond Lane.  
 Cambridge Street, near Winsor Street.  
 Mount Auburn Street, near Athens Street.  
 North Avenue, near Spruce Street.

### Service Pipes.

Diameter in Inches.	Number of Pipes	Length in Feet.	TOTALS.	
			Number of Pipes.	Length in Feet.
2	32	1,908	32	1,908
1½	8	416	8	416
1½	2	120	2	120
1	12	839	12	839
¾	363	25,488	363	25,488
Aggregate . . . . .			417	28,771

The total number of supply pipes is 6,236.

NT OF LOCATION, SIZE, AND NUMBER OF FEET OF PIPE  
LAID IN 1874.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
. . . . .	4	48
. . . . .	4	180
. . . . .	6	884
. . . . .	4	195
. . . . .	4	160
. . . . .	4	180
. . . . .	4	176
. . . . .	12	795
. . . . .	6	778
. . . . .	6	580
. . . . .	6	250
. . . . .	6	557
. . . . .	6	18
. . . . .	4	182
. . . . .	4	160
. . . . .	6	60
. . . . .	4	50
. . . . .	6	415
. . . . .	8	1,010
. . . . .	6	407
. . . . .	4	64
. . . . .	4	1,284
. . . . .	4	180
& Co.'s yard . . . . .	6	108
. . . . .	4	270
. . . . .	4	250
. . . . .	4	265
. . . . .	6	16
rd Four) . . . . .	6	26
rd Four) . . . . .	4	570
. . . . .	4	200
. . . . .	4	190
. . . . .	4	148
. . . . .	6	275
. . . . .	4	100
rn St., from Brighton St. to Putnam Avenue .	80	12
rn St., from Brighton St. to Putnam Avenue .	24	2,112
rn St., from Brighton St. to Putnam Avenue .	6	274
rn St. . . . .	6	275
. . . . .	4	26
urt . . . . .	4	151
. . . . .	6	228
ue, Harvard Square, and Brighton Street to burn Street . . . . .	20	1,620
ue, Harvard Square, and Brighton Street to burn Street . . . . .	6	110
. . . . .	6	60
. . . . .	6	78
. . . . .	12	235
nue . . . . .	24	180
nue . . . . .	10	75
nue . . . . .	6	106
in . . . . .	80	2,200

STATEMENT OF LOCATION, SIZE, &c. — *Continued.*

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Sixth . . . . .	8	230
Sixth . . . . .	6	106
Somerset . . . . .	4	25
Tremont . . . . .	4	87
Trowbridge . . . . .	4	134
Tufts . . . . .	4	126
Waterhouse . . . . .	6	19
Wendell . . . . .	6	815
Worthington . . . . .	6	104

## GATES.

IN WHAT STREET	Diameter in Inches.	Number.
Ash Court . . . . .	4	1
Beaver . . . . .	4	1
Boardman . . . . .	4	1
Bridge . . . . .	12	2
Bridge . . . . .	6	6
Bridge . . . . .	4	1
Bristol . . . . .	6	2
Broadway . . . . .	6	6
Cambridge . . . . .	6	1
Cambridge Common . . . . .	20	1
Flagg . . . . .	4	1
Front . . . . .	4	1
Garden . . . . .	6	1
Gore . . . . .	8	3
Gore . . . . .	6	3
Gore . . . . .	4	3
Hampshire . . . . .	4	2
Harvard . . . . .	10	1
Hastings . . . . .	4	2
Holyoke . . . . .	4	1
J. P. Squire & Co.'s Yard . . . . .	6	1
J. P. Squire & Co.'s Yard . . . . .	4	1
Kinnaird . . . . .	4	1
Langdon . . . . .	4	1
Lawrence . . . . .	4	1
Lincoln (Ward Four) . . . . .	6	1
Lincoln (Ward Four) . . . . .	4	2
Linden . . . . .	6	1
Lowell . . . . .	4	1
Madison . . . . .	4	1
Market . . . . .	4	1
Mead . . . . .	4	1
Mount Auburn St., from Brighton St. to Putnam Avenue . . . . .	24	2
Mount Auburn St., from Brighton St. to Putnam Avenue . . . . .	6	11
Mount Auburn St., from Brighton St. to Putnam Avenue . . . . .	4	1
Munroe . . . . .	6	2
Murdock Court . . . . .	4	1
North Avenue . . . . .	8	1
North Avenue . . . . .	6	1

STATEMENT OF LOCATION, SIZE, &c. — Continued.

IN WHAT STREET.	Diameter in Inches.	Number.
Avenue . . . . .	8	1
Avenue, Harvard Square, and Brighton Street to unt Auburn Street . . . . .	20	2
Avenue, Harvard Square, and Brighton Street to unt Auburn Street . . . . .	8	1
Avenue, Harvard Square, and Brighton Street to unt Auburn Street . . . . .	6	2
Avenue, Harvard Square, and Brighton Street to unt Auburn Street . . . . .	4	1
and . . . . .	12	1
im Avenue . . . . .	16	1
im Avenue . . . . .	10	1
im Avenue . . . . .	6	1
im Avenue . . . . .	4	2
voir . . . . .	24	5
. . . . .	10	1
. . . . .	6	1
. . . . .	12	1
. . . . .	6	1
ont . . . . .	4	1
rhouse . . . . .	6	1
lell . . . . .	6	1
er . . . . .	6	1
hington . . . . .	6	8

BLOW-OFF PIPES.

IN WHAT STREET.	Diameter in Inches.	Number.
a . . . . .	1½	1
. . . . .	1½	1
. . . . .	1½	1
ourt . . . . .	1½	1
e . . . . .	1½	1
line . . . . .	1½	1
. . . . .	1½	1
t Auburn St., from Brighton St. to Putnam Avenue .	6	2
Avenue, Harvard Square, and Brighton Street to ant Auburn Street . . . . .	6	1
. . . . .	1½	1
bridge . . . . .	1½	1

## WATER WORKS.

### RECAPTULATION.

2,212	2,243	1,060	1,080	75	1,240	6,078	5,220
20	24	20	12	10	8	6	4

**GATES.**

[illegible]

## BLOW-OUT PIPES.

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## STATEMENT

OF STOCK ON HAND EXCLUSIVE OF TOOLS AT SHOP.

## Galvanized Pipe.

160 feet 2-inch.	600 feet $\frac{3}{4}$ -inch.
460 feet $1\frac{1}{2}$ -inch.	300 feet $\frac{1}{2}$ -inch.
1,000 feet $1\frac{1}{4}$ -inch.	100 feet $\frac{3}{4}$ -inch, rubber-coated.
600 feet 1-inch.	

## Fittings for Service Pipes.

11 1-inch hose bibbs.	80 2-inch T's.
17 $\frac{3}{4}$ -inch hose bibbs.	45 $2 \times 1\frac{1}{2}$ -inch T's.
65 $\frac{1}{2}$ -inch compression bibbs.	40 $2 \times 1\frac{1}{4}$ -inch T's.
20 $1\frac{1}{4}$ -inch screw cocks.	30 $1\frac{1}{2}$ -inch T's.
12 1-inch screw cocks.	40 $1\frac{1}{2} \times 1\frac{1}{4}$ -inch T's.
70 $\frac{3}{4}$ -inch screw cocks.	30 $1\frac{1}{2} \times 1$ -inch T's.
11 1-inch sidewalk cocks.	20 $1\frac{1}{2} \times \frac{3}{4}$ -inch T's.
126 $\frac{3}{4}$ -inch sidewalk cocks.	80 $1\frac{1}{2}$ -inch T's.
75 1-inch M. & F. cocks for cement pipe.	40 $1\frac{1}{4} \times 1$ -inch T's.
8 $\frac{3}{4}$ -inch garden hydrant cocks.	25 $1\frac{1}{4} \times \frac{3}{4}$ -inch T's.
6 $1\frac{1}{4}$ -inch blow-off cocks.	80 1-inch T's.
6 $1\frac{1}{2}$ -inch corporation cocks.	250 $\frac{3}{4}$ -inch T's.
20 $\frac{3}{4}$ -inch corporation cocks.	275 $\frac{3}{4} \times \frac{1}{2}$ -inch T's.
6 2-inch cocks.	40 $\frac{1}{2}$ -inch T's.
6 $1\frac{1}{2}$ -inch cocks.	2 2-inch elbows.
11 1-inch cocks.	70 $1\frac{1}{2}$ -inch elbows.
6 2-inch stop and waste cocks.	80 $1\frac{1}{4}$ -inch elbows.
6 $1\frac{1}{2}$ -inch stop and waste cocks.	100 1-inch elbows.
12 $1\frac{1}{4}$ -inch stop and waste cocks.	38 $\frac{3}{4}$ -inch elbows.
13 1-inch stop and waste cocks.	25 $\frac{1}{2}$ -inch elbows.
61 $\frac{3}{4}$ -inch stop and waste cocks.	75 1-inch street elbows.
12 $\frac{3}{4}$ -inch hose nipples.	95 $\frac{3}{4}$ -inch street elbows.
100 $\frac{3}{4}$ -inch solder nipples and unions.	80 2-inch couplings.
Fire hydrant stop and wastes.	90 $1\frac{1}{2}$ -inch couplings.
	12 $1\frac{1}{4}$ -inch couplings.
	420 1-inch couplings.

30  $\frac{3}{4}$ -inch couplings.  
 300  $\frac{1}{2}$ -inch couplings.  
 15 1-inch air chambers.  
 206  $\frac{3}{4}$ -inch air chambers.  
 150  $\frac{1}{2}$ -inch air chambers.  
 2 2-inch unions.  
 25  $1\frac{1}{2}$ -inch unions.  
 30  $1\frac{1}{4}$ -inch unions.  
 20 1-inch unions.  
 25  $\frac{3}{4}$ -inch unions.  
 10  $\frac{1}{2}$ -inch unions.  
 50 1-inch clips.  
 90  $\frac{3}{4}$ -inch clips.  
 40  $\frac{1}{2}$ -inch clips.  
 20 2-inch crosses.  
 8  $2 \times 1\frac{1}{2}$ -inch crosses.  
 2  $2 \times 1\frac{1}{4}$ -inch crosses.  
 12  $2 \times 1$ -inch crosses.  
 12  $1\frac{1}{2}$ -inch crosses.  
 12  $1\frac{1}{2} \times 1\frac{1}{4}$ -inch crosses.  
 20  $1\frac{1}{2} \times 1$ -inch crosses.  
 30  $1\frac{1}{2} \times \frac{3}{4}$ -inch crosses.  
 25  $1\frac{1}{4}$ -inch crosses.  
 20  $1\frac{1}{4} \times 1$ -inch crosses.  
 20  $1\frac{1}{4} \times \frac{3}{4}$ -inch crosses.  
 12 1-inch crosses.  
 15  $1 \times \frac{3}{4}$ -inch crosses.  
 12  $\frac{3}{4}$ -inch crosses.

250  $\frac{3}{4}$ -inch socket ends.  
 15 garden hydrants.  
 6 2-inch nipples.  
 50  $1\frac{1}{2}$ -inch nipples.  
 50  $1\frac{1}{4}$ -inch nipples.  
 50 1-inch nipples.  
 30  $\frac{3}{4}$ -inch nipples.  
 50  $\frac{1}{2}$ -inch nipples.  
 6 2-inch plugs.  
 6  $1\frac{1}{2}$ -inch plugs.  
 10  $1\frac{1}{4}$ -inch plugs.  
 12 1-inch plugs.  
 20  $\frac{3}{4}$ -inch plugs.  
 15  $\frac{1}{2}$ -inch plugs.  
 20  $2 \times 1\frac{1}{2}$ -inch bushings.  
 24  $2 \times 1\frac{1}{4}$ -inch bushings.  
 12  $2 \times 1$ -inch bushings.  
 15  $2 \times \frac{3}{4}$ -inch bushings.  
 10  $1\frac{1}{2} \times 1\frac{1}{4}$ -inch bushings.  
 14  $1\frac{1}{2} \times 1$ -inch bushings.  
 12  $1\frac{1}{2} \times \frac{3}{4}$ -inch bushings.  
 17  $1\frac{1}{2} \times 1$ -inch bushings.  
 12  $1\frac{1}{4} \times \frac{3}{4}$ -inch bushings.  
 30  $1 \times \frac{3}{4}$ -inch bushings.  
 25  $\frac{3}{4} \times \frac{1}{2}$ -inch bushings.  
 80 1-inch lock nuts.  
 100  $\frac{3}{4}$ -inch lock nuts.  
 40  $\frac{1}{2}$ -inch lock nuts.

#### Miscellaneous.

50 tons old junk.  
 4 wagons.  
 2 hand-carts.  
 2 horses.  
 3 sets harnesses.  
 1 pung.

1 large hand-pump.  
 1 thawing stove.  
 1 large boom derrick.  
 2 tons lead.  
 2 barrels clay.  
 200 pounds hemp packing.

## Stock at Pipe Yard.

48-inch pipe.	2 8-inch clamp sleeves.
s 36-inch pipe.	1 6-inch clamp sleeve.
s 30-inch pipe.	1 30-inch $\frac{1}{16}$ bend.
s 24-inch pipe.	2 24-inch $\frac{1}{4}$ bends.
s 20-inch pipe.	1 24-inch $\frac{1}{8}$ bend.
hs 16-inch pipe.	1 24-inch $\frac{1}{16}$ bend.
hs 12-inch pipe.	2 16-inch $\frac{1}{8}$ bends.
hs 10-inch pipe.	2 12-inch $\frac{1}{4}$ bends.
s 8-inch pipe.	10 10-inch $\frac{1}{8}$ bends.
hs 6-inch pipe.	12 6-inch $\frac{1}{8}$ bends.
s 4-inch pipe.	12 6-inch $\frac{1}{4}$ bends.
12-inch cross.	2 16 $\times$ 6-inch blow-offs.
10-inch crosses.	1 20 $\times$ 6-inch blow-off.
3-inch cross.	10 hydrant pipes.
12-inch crosses.	1 24-inch T.
3-inch cross.	1 24 $\times$ 12-inch T.
1 cross.	1 24 $\times$ 8-inch T.
10-inch crosses.	3 24 $\times$ 6-inch T's.
6-inch crosses.	1 20-inch T.
4-inch crosses.	3 20 $\times$ 12-inch T's.
3-inch crosses.	4 20 $\times$ 6-inch T's.
inch crosses.	8 16 $\times$ 6-inch T's.
inch crosses.	2 12-inch T's.
1 crosses.	7 12 $\times$ 6-inch T's.
1 sleeves.	3 12 $\times$ 4-inch T's.
1 sleeves.	1 12 $\times$ 8-inch T.
1 sleeves.	24 10 $\times$ 6-inch T's.
1 sleeves.	1 10 $\times$ 4-inch T.
ch sleeves.	1 8 $\times$ 8-inch T.
1 sleeves.	4 8 $\times$ 6-inch T's.
sleeves.	1 8 $\times$ 4-inch T.
1 sleeves.	10 6 $\times$ 4-inch T's.
1 sleeves.	16 4-inch T's.
1 clamp sleeves.	1 24 $\times$ 10-inch reducer.
1 clamp sleeves.	1 20 $\times$ 12-inch reducer.
1 clamp sleeves.	2 16 $\times$ 6-inch reducers.

3 12 × 10-inch reducers.	1 16-inch gate.
2 12 × 8-inch reducers.	3 12-inch gates.
3 10 × 8-inch reducers.	8 10-inch gates.
3 10 × 6-inch reducers.	2 8-inch gates.
1 8 × 6-inch reducer.	6 6-inch gates.
9 6 × 4-inch reducers.	6 4-inch gates.
4 4 × 3-inch reducers.	1 4-inch meter.
1 12-inch cap.	1 1½-inch meter.
8 10-inch caps.	3 1½-inch meters.
5 6-inch caps.	4 1-inch meters.
10 4-inch caps.	6 ¾-inch meters.
8 10-inch offsets.	2 large frames and covers.
34 6-inch offsets.	6 frames and covers.
9 4-inch offsets.	12 small frames and covers.
24 6-inch offsets, double.	

#### Stock at Engine House.

1,059 tons of coal.	25 gallons lard-oil.
1 bale cotton waste.	5 gallons kerosene oil.
30 pounds Martin's packing.	1 rotary pump.
30 gallons cylinder oil.	And all the requisite tools.

Finally, the following officers and men's services are required in the management of the Works : —

#### In Office at City Hall.

- 1 Water Registrar.
- 1 Assistant Clerk.
- 1 Inspector of fixtures, bill distributor, &c.

#### On the General Management and Work.

- 1 Superintendent.
- 3 Foremen.
- 7 Permanent men employed as jointers and repairers.

#### At Pumping Works.

- 1 Engineer.
- 1 Assistant Engineer.
- 2 Firemen.

Two horses owned by the City are constantly used on the work.

When a large number of men are employed by the day in laying long lines of large main pipes, none are hired but those who reside in Cambridge, whose duty it is to work in harmony with each other and for the good of all concerned, under the direction of the Water Board.

Respectfully submitted.

S. W. DUDLEY,

*Superintendent.*



City of Cambridge.

THE  
ELEVENTH ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL,

TOGETHER WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
AND OTHER DOCUMENTS,

FOR THE YEAR 1875.



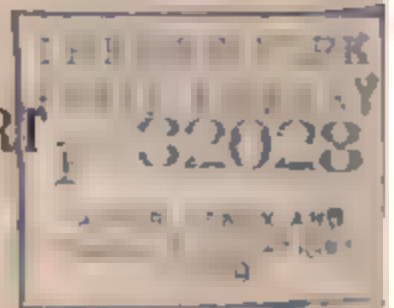
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34 SCHOOL STREET  
1876.





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☆ CAMBRIDGE PUB. LBRY



# REPORT

## OF THE

### CAMBRIDGE WATER BOARD.

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*To the City Council of the City of Cambridge :*

IN accordance with the requirements of the City Ordinance, the Cambridge Water Board herewith submits to you its Eleventh Annual Report.

#### Cost of the Works.

Net cost of the Water Works Nov. 30, 1874,	
as per last year's report . . . . .	\$1,399,396 53
Expended for extension account during the year	
ending Nov. 30, 1875 . . . . .	153,170 67
Making total cost Nov. 30, 1875 . . . . .	\$1,552,567 20

Previous to June 30, 1875, the sum of \$180,100 was taken from the Sinking Fund and appropriated to the payment of a like amount of the City Water Debt, and these two accounts will now stand as follows : —

Amount of Water Debt representing the cost	
of the Water Works as above . . . . .	\$1,552,567 20
Less amount of Water Debt paid . . . . .	180,100 00
Leaving amount of Water Debt unpaid . . . . .	\$1,372,467 20
Amount of Sinking Fund . . . . .	\$314,429 21
Less payment on Water Debt . . . . .	180,100 00
	\$134,329 21

This balance of Sinking Fund remaining,  
deducted from the unpaid Water Debt,  
leaves the net cost of the Water Works, \$1,238,137 89

### Comparative Receipts.

Receipts for Water Rates for the year ending

Nov. 30, 1874 . . . . .	\$153,634 27
Receipts for the year ending Nov. 30, 1875 .	138,880 37
Showing decrease for the year 1875 . . .	<u>\$14,753 90</u>

This is the first year in the history of the Water Works when the receipts of the current year have not exceeded those of the previous year. It is accounted for as follows:—

1. We have put in a less number of new supplies than usual the past year.

2. Many houses are vacant and manufacturers are doing less business, and, consequently, use less water.

3. And, principally, because the water rates due from the City have not been passed to our credit.

There is due the Water Works from the City, on the basis on which our water bills have been made out and paid heretofore, as follows:—

Amount due on supply account . . . . .	\$2,681 19
“ Water Rates for 1873 . . . . .	3,929 0
“ “ “ 1874 . . . . .	6,804 6
“ “ “ 1875 . . . . .	27,915 9
Total . . . . .	<u>\$41,330 7</u>

MEMO. — We are informed that since November 30, the close of our year, the City Council has amended the Ordinance of Water Rates, making special rates for water furnished for watering streets, and for hydrants. If the above-named bills are settled on the new rates, the above amount will be cut down to \$19,813.96, being a reduction of \$21,516.77.

Statement showing the entire transactions in brief on account of the Water Department for the year ending Nov. 30, 1875—

**Received.**

Amount of appropriation for extension . . .	\$160,000 00
From water rates . . . . .	138,880 37
“ supply account, and shutting off and letting on water . . . . .	8,439 21
From rent of house . . . . .	150 00
“ interest on Sinking Fund to June 30 . . .	16,955 21
“ “ current account . . . . .	2,568 99
“ accrued interest on bonds sold . . . . .	1,448 83
	<u>\$328,442 61</u>

**Expended.**

For extension account . . . . .	\$153,170 67
“ care and repairs . . . . .	28,651 77
“ supply account . . . . .	12,498 59
“ interest on Water Debt to June 30, 1875 . .	85,404 00
“ unexpended appropriation . . . . .	6,829 33
Balance showing gain in 1875 . . . . .	41,888 25
	<u>\$328,442 61</u>

The following table will show the comparative rainfall and height of water in the pond during the years 1874 and 1875:—

	Rainfall, 1874, Inches.	Rainfall, 1875, Inches.	Below high- water mark, 1874, Inches.	Below high- water mark, 1875, Ft & inches.
December, 1874 . . . . .	4.04	1.50	36.62	5 feet 9
January, 1875 . . . . .	3.28	3.22	21.62	6 “ 6
February, “ . . . . .	4.42	3.54	24.37	7 “ 4½
March, “ . . . . .	1.49	8.10	29.	6 “ 7½
April, “ . . . . .	6.39	4.73	27.23	5 “ 7
May, “ . . . . .	3.50	3.08	20.88	5 “ 5
June, “ . . . . .	3.87	6.60	23.50	4 “ 2½
July, “ . . . . .	2.54	2.88	33.75	5 “ 8½
August, “ . . . . .	6.82	5.66	35.37	6 “ 0½
September, “ . . . . .	1.52	3.46	45.38	6 “ 4½
October, “ . . . . .	1.07	3.83	54.	6 “
November, “ . . . . .	2.33	4.86	59.62	5 “ 9½
Total . . . . .	41.87	51.46		

It will be seen by this table that there were 9.59 inches of rainfall in 1875 more than in 1874, and the water in the pond remained within one half inch at the close of the year where it was in the beginning. By reference to the Superintendent's Report it will be seen that we pumped in 1875, 992,247,000 gallons, while in 1874 we pumped 839,183,100, showing excess in 1875 over 1874 to be 153,063,900 gallons. This excess can nearly all be accounted for by the extraordinary demands made on us last winter, and has been supplied by the increased rainfall, and also by considerable water which has found its way into the pond from Wellington Brook and Little Pond, through the new conduit and otherwise.

The following statement will show the cost of the Water Works and their progress, financially, up to the present time : —

Year.	Cost of Works.	Water Rates.	Sinking Fund.
1865	\$94,888 91	\$32,367 19	
1866	383,074 65	40 073 27	\$6,367 77
1867	571,699 71	52,733 62	12,568 12
1868	732,196 09	63,747 42	24,100 86
1869	831,509 60	76,149 30	27,726 44
1870	888,416 06	92,606 95	59,673 62
1871	945,146 45	111,782 65	89,811 12
1872	1,030,384 66	127,201 30	131,072 67
1873	1,243,415 07	146,117 32	189,410 16
1874	1,399,396 53	158,634 27	256,203 18
1875	1,552,667 20	139,060 37	314,429 21

The following table will show the progress of the Water Works in reference to the Water Supply : —

Year.	No. Supplies.	Pounds coal used.	Gallons water pumped.	Gallons. Daily average.	Gallons at 'ge to Supply
1865	2,191	559,100	851,176,396	962,127	439
1866	2,362	635,250	405,639,084	1,111,339	471
1867	2,610	731,950	454,125,872	1,244,180	476
1868	3,117	769,608	632,456,848	1,732,759	556
1869	3,573	796,180	588,763,182	1,613,050	451
1870	4,191	1,112,750	635,052,196	1,739,869	415
1871	4,894	1,402 390	637,912,150	1,747,704	368
1872	5,325	1,522,650	593,492,156	1,626,006	305
1873	5,819	1,535,400	775,583,000	2,124,884	365
1874	6 236	1,737,864	839,183,100	2,299,146	369
1875	6,570	1,758,300	992,247,000	2,718,484	414



It will be seen by this table that the daily average amount of water we have furnished each supply has been 419 gallons through eleven years, while for the past five years it has been but 362 gallons; a decided gain in this direction.

In our last Report we said we should ask for an appropriation to enable us to do the following work:—

" *First.* — To connect Fresh, Little, and Spy Ponds by a suitable conduit, to make available the water supplied from these sources.

" *Second.* — To clean out the borders of Fresh Pond near our pumping works where the bottom of the pond becomes exposed at low water.

" *Third.* — To lay some more main pipes, as hereinbefore more fully set forth.

" *Fourth.* — To provide suitable buildings to accommodate our engineers and firemen, whom we are obliged to employ about the Works all the time, and who should be on the ground, where their services can be commanded at all times night and day."

Upon examination it was found that our right to take the waters of Wellington Brook and Little and Spy Ponds was only by implication, and not by a clear and undoubted grant from the Legislature. This being so, it was deemed best before any work was done to connect these sources of supply that application should be made to the Legislature for the express right to do so. Application was therefore made in due form, and we were summoned several times to appear before the committee having it in charge, and show why we wanted the water. Our necessities in the case were made so plain that, although we met some opposition from Belmont and Arlington parties, and some from the ice interests, yet, after a full and exhaustive examination of the whole matter, the Legislature granted us the following Act under which we proceeded with the work:—

[CHAP. 165.]

## AN ACT

TO PROVIDE A FURTHER SUPPLY OF WATER FOR THE CITY OF CAMBRIDGE.

*Be it enacted, etc., as follows:*

SECTION 1. The City of Cambridge, for the purpose of supplying said city and the inhabitants thereof with pure water for the extinguishment of fires, for domestic and other purposes, may take, hold, and convey into and through said city the waters of Spy Pond, in the town of Arlington, and of Little Pond, in the town of Belmont, and of Wellington Brook, in said Belmont, and the waters that flow into said ponds or brook, or either of them; may connect the same or any part thereof with Fresh Pond, and may take and hold by purchase or otherwise such land on and around the margin of said ponds, including Fresh Pond, not exceeding five rods in width, as may be necessary for the preservation and purity of said waters, and may also take and hold in like manner such lands as may be necessary for erecting and maintaining dams and reservoirs, and for laying and maintaining conduits, pipes, drains, and other works for collecting, conducting, and distributing said waters into and through said city either by the way of Fresh Pond or otherwise: *provided, however*, that said city shall not hereby acquire any right to take ice from either of said ponds, or to take land upon which any building or machinery is now erected, or which is used in connection with such building or machinery for the purpose of storing ice or for convenience in cutting, storing, and moving ice, without the consent of the owner of said land and buildings or machinery, and shall not obstruct, by ditches, buildings, or other structures, the rights of such owners in the cutting, storing, and moving of ice, except so far as the same shall result from the raising or lowering of the surface of the water of said ponds, or either of them, and except so far as is necessary for the preservation of the purity of the waters of said ponds; but nothing in this Act shall be construed to give additional rights to said city to lower the surface of said Fresh Pond below the point now authorized by law.

SECT. 2. Said city, by its mayor, shall, within sixty days after taking any lands for the purposes of this Act, file in the registry of deeds of the county and district in which such land lies a description of the land so taken as certain as is required in a common conveyance of land.

SECT. 3. Said city, for the purposes aforesaid, may build aqueducts and maintain the same by any works suitable therefor; may erect and maintain dams; may make and maintain suitable reservoirs; may make and establish such public fountains and hydrants as may from time to time be deemed proper, and may change or discontinue the same: may regulate the use of water, and establish the price or rents to be paid therefor, and collect the same by process of law. Said city may, also, for the purposes aforesaid, carry its pipes and drains over or under any watercourse, street, railroad, highway, or other way, in such manner as not to obstruct the

same; and may enter upon and dig up such road, street, or way, for the purpose of laying down, maintaining, or repairing pipes or drains, and may do any other things necessary and proper in executing the purposes of this Act.

SECT. 4. If said city enters upon and digs up, for the purposes aforesaid, any road, street, or way which is outside of the limits of said city, it shall do so under the direction of the selectmen of the town in which said road, street, or way is located, and shall restore said road, street, or way to as good order and condition as it was in before such digging was commenced; and the work shall be done in such manner, and with such care, as not to render any road, street, or way in which such pipes are laid unsafe, or unnecessarily inconvenient to the public travel thereon. Said city shall, at all times, indemnify and save harmless any such town which is liable to keep in repair any road street, or way aforesaid, against all damages which may be recovered against it, and shall reimburse to it all expense which it shall reasonably incur by reason of any defect or want of repair in such road, street, or way caused by the maintenance, repairing, or replacing of said pipes, or by reason of any injury to persons or property caused by any defect or want of repair in any such pipes: *provided*, that said city has notice of any claim or suit for such damage or injury, and an opportunity to assume the defence thereof.

SECT. 5. Said city shall be liable to pay all damages sustained by any persons or corporations by the taking of, or injury to, any of their land, water, water-rights, rights of way or property, or by the constructing of any aqueduct, reservoir, or other works for the purposes aforesaid. If any person or corporation sustaining damages as aforesaid cannot agree with said city upon the amount of said damages, he may, within three years from such taking or construction, have them assessed in the same manner as is provided by law with respect to land taken for highways.

SECT. 6. All the rights, powers, and authority given to the city of Cambridge by this Act shall be exercised by said city, subject to all duties, liabilities, and restrictions herein contained in such manner and by such agents, officers, and servants, as the city council shall from time to time ordain, direct, and appoint.

SECT. 7. Whoever wantonly or maliciously diverts the water, or any part thereof taken or held by said city pursuant to the provisions of this act, or corrupts the same, or renders it impure, or destroys or injures any dam, aqueduct, pipe, conduit, hydrant, machinery or other works or property held, owned or used by said city under the authority and for the purposes of this Act, shall forfeit and pay to said city three times the amount of the damages assessed therefor, to be recovered in an action of tort; and on conviction of either of the wanton or malicious acts aforesaid, may also be punished by fine not exceeding three hundred dollars, or by imprisonment not exceeding one year in the House of Correction in said county of Middlesex.

SECT. 8. This Act shall take effect upon its passage. [*Approved May 1, 1875.*]



### Account of Work done.

*First.* — During the year, a conduit of suitable size has been constructed connecting Fresh Pond with Wellington Brook and Little Pond, giving us direct connection with them, and control of the water furnished from these sources, and indirectly through Little Pond we control the water flowing from Spy Pond. This gives us a large amount of water that we can rely upon to reinforce Fresh Pond when it is necessary, and at the same time increases our storage capacity by the area of about one hundred and fifty-six acres. This last item is of great importance to us where our capacity to catch and retain the water when it comes enters so largely into the value of our water supply.

*Second.* — The work of "cleaning out the borders of Fresh Pond near our Engine-House" was one requiring a large outlay; and while the Water Board had no doubt that it ought to be done, it was thought best that the City Council should be invited to visit the pond, and their views ascertained before the work was commenced. This was done, and the feeling seemed unanimous on their part that it should be done at the earliest moment. This work was therefore commenced in September, and has been continued, when the weather would permit, up to this time. A very large part of the excavating has been done already, and should the season prove favorable, it is hoped that it will all be completed before the work is stopped. The paving of the banks cannot be finished this season, as it is necessary that the upper part of the banks should have time to settle, and thus this work cannot be completed until spring.

*Third.* — During the year the following main pipes have been laid in continuance of the work reported last year. A twenty-inch through Green, Sidney, Front, and Osborn Streets to Main Street at Portland. A ten and twelve inch pipe on Harvard Street. The laying of these pipes has greatly reinforced the supply of water in those portions of the city for ordinary uses, but the principal advantage has been the increased facilities for furnishing water for the use of the Fire Department, the benefit of which has already been experienced.

*Fourth.* — At the date of our last Report our old pump was in New York, to be thoroughly overhauled. Since then it has been returned and set up in its place in the new engine-house. Such alterations were made as were necessary to make it conform in appearance to our new pump, and such repairs were made as to make it practically as good as new. We have now two pumps in perfect condition, each of them of the capacity of 5,000,000 gallons daily delivery, and they are supplied with steam boilers, feed-pumps, and all other needed appliances to ensure us a complete duplicate pumping power. We do not see that any further expense in this direction will be required for several years to come, except the current ordinary repairs, which, from our past experience, will be very small.

Nothing has been done in regard to providing suitable buildings for our employees at the engine-house, as other things which seemed more important have claimed our attention during the whole year.

During the past year a thorough examination and inspection of the Water Works have been made, all the fixtures in the buildings were examined, and where needed repairs were made. A full report of the particulars connected therewith will be made to the Water Board by a committee who have the matter in charge.

The result of this examination has only confirmed what was already known: that is, that a very large amount of water is lost all the time by wastage, and the question comes up again and again: Can nothing be done to stop it? In reply, we say, Yes, it can be done, but the expense of doing it at present makes it impracticable. We find that in countries where water is very scarce, and is furnished at great cost, this matter has received practical and successful attention, and, in order that it may be brought before you fairly, we herewith give you extracts from the Report of Geo. F. Deacon, Esq., Water Engineer for the City of Liverpool, England, where the matter of wastage of water has been treated with more success than anywhere else that we know of. We are indebted to the Report of the Cochituate Water Board for 1874 for this paper, and we commend it to your careful consideration.

It will be noted that there "the cost of water, say ninepence

a thousand gallons," is equal to \$187.50 per million gallons, while with us, if we make up the cost in the usual way, by taking the cost of the coal we use, and adding the ordinary expense of care and repair, we shall find the cost of our water for 1876 to be less than \$12 per million gallons. It will thus be readily seen that what might be a good and economical system where the water costs \$187.50 per million gallons, might be an expensive and useless system where the water costs only \$12 per million gallons. The principal advantage of presenting this experience and success of others in treating the subject of wastage of water, is to show you that it can be done; and it is worth something to know what we can do if the necessity is ever laid upon us, or when it will pay.

While we present the experience at Liverpool as the only real successful result attained, we are not without hope that some other practical way of reaching the subject may yet be found. In a former Report made to this Board we find the following words, which seem to present this matter in a concise way: "No practicable and efficient remedy for this waste has not been discovered and applied, so far as we know; a meter set at each supply would secure pay for the water we furnished, and probably stop nearly all the waste, as people are not likely to waste what they pay for directly; but until a cheaper meter than now on the market is furnished, this remedy is too expensive, as it costs more than the disease." Until something of this kind is presented, we know of no better way than to continue in our present and long practised course of energetic, persistent effort in the management of the Water Works in order to attain the best possible practical results.

#### General Remarks.

The last winter was one of unprecedented severity in reference to water pipes, both in the streets and on the premises of water takers. In some streets the main pipes froze solid, while hundreds of our customers were deprived of water by the freezing of their service pipes. Every means known to us was used to make this difficulty as light as possible, but we could not have



our own with King Frost after he got well started. The effect was that those who were not frozen up, fearing they would be, commenced a general system of letting their faucets run all night to keep their pipes from freezing. This remedy generally proved effectual, but it caused an unprecedented demand on us for water to supply this great waste. Although we are now drawing our water from the pond through the new pipe, which is more than four feet lower than the one used the year before, yet so near did we come to exhausting the power of the pipe to supply us by the falling of the water in the pond, that the Board authorized preparations to be made to pump into the pipe as a last resort. Providentially, the heavy rains early in the spring saved us from using the last resort. This experience, however, fully demonstrated that our new conduit just completed and reaching other sources of supply was not built a day too soon.

Before the work of cleaning out the pond was commenced, negotiations were made with the "Tudor heirs," in regard to a long, low, unsightly piece of ground reaching from Concord Turnpike to our engine-house lot, and lying between the railroad and the new street running from Concord Turnpike to the engine-house. As a result, the "Tudor heirs" have agreed to convey the same to the City without charge, but upon the condition that the same should be graded up and kept as a common, free of all buildings, thus securing a free and unobstructed view of the pond from Concord Turnpike to the new depot near our engine-house. As this was the most favorable place of any whercon to deposit the material taken out of the pond, a double advantage has been thus attained.

Enough has already been done to show that when the work is completed the former unsightly and filthy slough will be transformed into a cleanly and beautiful place. Indeed, it will without doubt become one of the most attractive places of resort in our City, to which any of our citizens can take their visiting friends, and show them with commendable pride where our City gets her water, which will be in great contrast with our former experience, when it was necessary to apologize and excuse as best we could the surroundings of our Water Works. So far



as we have heard any expression from our citizens or others in regard to this work, it has been one of universal commendation, and the only surprise is that we have not done the work before. It should be remarked that the new conduit connecting the ponds, and the work of cleaning out the pond, have been done under the supervision of our City Engineer.

In comparing our Water Works as they are at present with what they were eleven years ago, when the City bought them, we see great and important changes have taken place. Indeed, they are to-day practically new Water Works: scarcely a vestige of the original works remain; nearly everything has been rebuilt or superseded by something adapted to our present and prospective wants. Among these changes may be noted the following:—

The original pumps have been outgrown, and they are succeeded by new and larger ones.

The old engine-house has been left for a new one, made large and commodious enough to supply our wants in that direction to the extent of our present water supply.

The old pipe into the pond has been taken out, and a new one put down of larger size and more than four feet deeper in the pond.

The old pumping main has been taken up, and two new ones of large size and in a better location have been put down.

The old reservoir has been rebuilt almost completely, and a new one built alongside of it, thus duplicating our reservoirs; and in connection with them we have built a stand-pipe, to give increased head to our water, and supply the high grounds of our city.

New distributing mains have been laid from the reservoir to all parts of the City, of large size, for distributing the water, and nearly all the old pipes have been replaced by new ones in the streets, while to a great extent the supply pipes have been renewed by putting in other and better ones.

During the past year the new conduit has been laid, connecting us with other sources of our water supply, and the work of cleaning out objectionable material from our pond has been well commenced.

As we now look over the works they seem almost completed, so far as our present sources of water supply are concerned, and but little remains to do except to finish up the work already begun.

We enumerate the things that as it seems to us ought to be done in carrying out this work to completion, and for which we shall ask from you an appropriation at the proper time.

*First.* — Finish up the work, already far advanced, of cleaning out that part of the pond near the engine-house.

*Second.* — Clean out that part of the pond known as Black's Nook, where our new conduit enters Fresh Pond.

*Third.* — Build a conduit to connect Spy with Little Pond at its outlet, with suitable dam and gate-houses, so that we shall have full control of the water, and also, by so doing, improve and take possession of all the rights granted to us by the Legislature.

*Fourth.* — Build a suitable cottage for our engineer, using the material of our old engine-house for this purpose, which, with the lumber we shall have about the pond when the clearing up is done, will furnish a large part of what will be required.

Undoubtedly other things will be found necessary in the future, to improve the purity of our water and increase our resources, but at present the above enumerated things to be done are all that our immediate wants require.

For the details of what has been done in the ordinary prosecution of the work connected with the Water Works, and for the present condition of the property, and accounts connected therewith, we would refer you to the Reports of the Registrar and Superintendent herewith submitted.

C. W. KINGSLEY.

H. L. EUSTIS.

J. WARREN MERRILL.

SAMUEL SLOCOMB.

GEORGE P. CARTER.

GEORGE F. PIPER.

# EXTRACTS

FROM THE

## REPORTS OF GEORGE F. DEACON, Esq.,

BOROUGH AND WATER ENGINEER, LIVERPOOL, ENGLAND.

THE engineer has the honor to submit the following statement of the measures which have been adopted for the prevention of waste and the restoration of constant service in fourteen districts selected for experimental purposes:—

The districts in question extend from Byrom Street and Scotland Road to Hatton Garden, Key Street, and Old Hall Street, and from Dale Street to Burlington Street. They comprise 5,403 houses, and a population of 31,000 persons.

The first step taken in each district was to attach a meter to the main pipe, in order to measure the quantity of water used; readings of the indexes were and are still taken at 6 A. M. and 6 P. M. daily, occasionally during the night, and in some cases hourly. These readings form a useful and interesting record of the varying demands upon the water, the extent of waste, and the influence of operations for its prevention. After connecting a meter to a district, the conditions of supply were left unchanged until a fair average had been obtained of the consumption under the intermittent system; constant service was then introduced and continued without interruption for some time; these preliminary facts having been placed on record, measures for the prevention of waste were commenced, and the effect of each operation upon the consumption noted. Waste Water Inspectors were sent to examine carefully and describe in detail all the pipes and fittings in every house, and to

ascertain the number of inhabitants. Night Inspectors were employed to examine for external indications of waste, and by sounding stop-cocks to discover defects in pipes; the defects reported were vigorously followed up, and notices served where repairs devolving upon the owners or occupiers were required. In several of the streets special examinations of the sewers were made, and contributed materially to the detection of leakages.

The first efforts to diminish waste by external plumbing work were made in connection with the fixing of stand-pipes in courts, where the taps were inside of the houses: a measure participated in by the Health Committee on sanitary grounds. The separate taps were disconnected, the old and generally light and defective pipes supplying the taps were taken up, and new piping was laid from the mains. In districts such as Henry Edward Street and Charters Street, where courts are numerous, the action produced material results; but it was found that branch pipes to trough closets, and to front houses adjoining the courts, which had not been interfered with, were constantly bursting, and it became necessary, in order to make the work in the courts effectual, to renew all those branches so as to clear away as much as possible of the old piping. This course has since been pursued systematically wherever stand-pipes have been laid. In districts where courts are comparatively few, the alterations in connection with the erection of stand-pipes had very little influence in reducing the consumption.

During the progress of these works frequent leakages were discovered in the street pipes, both of lead and iron, which throughout the districts were known to be for the most part old and shallow; it was obviously important to place the corporation pipes in a sound condition, while calling upon owners and occupiers to repair defects upon private property; an examination was therefore made of all the lead communication pipes, and where necessary they have been taken up, and strong, new pipes laid at a proper depth from the surface, while in several streets the iron pipes have been entirely renewed; at the same time stop-cocks have been attached to each



lead pipe, so that the supply can be controlled from the tap and the water at once shut off in the event of a break, with very little inconvenience.

The renewal of street pipes has merely been the correction at a particular time, and the systematic performance of the works which must, in any event, have been carried on at short time.

The following statement shows the length of piping taken up and laid in connection with the work already described:

	Old Pipe taken up. Feet.
In connection with stand-pipes in courts within the 14 districts . . . . .	39,267
In connection with stand-pipes in courts outside the 14 districts . . . . .	10,851
In streets, relaying service-pipes . . . . .	14,934
Total lead pipe . . . . .	65,052

The first item includes piping to trough closets and to front houses, referred to above. The defects in the piping taken up were numerous; their character, and the general condition of the piping, may be judged from the specimens which have been preserved, and may be seen at the engineer's office.

#### NIGHT INSPECTIONS.

Shortly after the fixing of the first district meter, a system of night inspections was commenced, and proved to be so positive in the discovery of leakages that it has been continued until the present time. There are two inspectors engaged on the night duty, and they report an average of 15 calls per night. By means of the stop-cocks they are enabled to stop even a slight trickling of water from a pipe or tap at a considerable distance. One inspector and two laborers are employed in following up and tracing during the day the leaks thus brought under notice. So far, the Night Inspectors have been confined entirely to the test districts. The following

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\* Full particulars of the cost of these operations were given in the engineer's report of 21st Oct. 1873, on the expenditure in connection with the erection of stand-pipes, and the prevention of waste water.

an analysis of the reports received from them up to the 31st ultimo. The nature of the defects is given as ascertained by the subsequent day examinations : —

Cocks . . . . .	345
Ball cocks . . . . .	103
Water-closets . . . . .	223
Pipes . . . . .	465
Trough water-closets . . . . .	56
Taps left open . . . . .	85
Stop-cocks . . . . .	65
Stand-pipes . . . . .	100
Hydrants, ferrules, plugs, etc. . . . .	61
Meters . . . . .	4
<b>Total . . . . .</b>	<b>1,507</b>

#### SEWER EXAMINATIONS.

In four of the districts where considerable waste from the street pipes was believed to take place, useful results have been obtained by night examinations of the sewers. When the ventilation and cleansing of the sewers has been completed, systematic and periodical examinations may be made, and there is no doubt such a course will lead to the discovery of a great deal of waste which now takes place unperceived.

#### HOUSE-TO-HOUSE INSPECTION.

Until recently two inspectors have been employed, with the occasional assistance of others, in house-to-house visits for the examination of fittings in these districts. Returns have been prepared which show the number and character of the various kinds of taps and fittings in every house. Where slight defects have been met with, the inspectors have themselves effected the necessary repairs; but where the defects have been of a more serious description, the usual notices have been served on the persons responsible.

A source of waste deserving of special mention is an arrangement which is, unfortunately, very common in these districts,

of flushing water-closets by means of a simple tap, and a pipe laid direct from the main or from a supply cistern; scarcely less objectionable are cisterns containing only single valves. The taps or valves are frequently left open, and large volumes of water flow to waste. Although the tenants are usually careful to close the taps or valves when the inspectors are near, no fewer than 88 such taps have been found open. The course adopted has been to cut off the supply, and serve a notice upon the landlord or tenant to provide a double-valve cistern of approved pattern.

The following table is a summary of the defects discovered by the Waste Water Inspectors, in each of the districts, from the time of fixing the meters until the end of October:—

TITLE OF DISTRICT.	NOTICES ISSUED FOR DEFECTS.					REPAIRS EFFECTED BY INSPECTORS.					
	Cocks.	Ball Cocks.	Water-Closets.	Pipes.	Total.	Cocks.	Ball Cocks.	Water-Closets.	Pipes.	Total.	Total No. noticed and repaired.
Henry Edward Street,	31	5	9	118	163	2	..	5	..	7	170
Charters Street . . .	65	12	25	95	197	8	3	..	..	11	198
Hatton Garden . . .	72	30	91	131	324	30	20	7	3	60	384
Blaspham Street . . .	26	..	6	66	98	6	2	1	2	11	109
Cockspur Street . . .	47	30	64	126	267	45	10	11	5	71	338
Gasouyne Street . . .	82	8	30	63	183	9	4	5	1	19	202
Plumbe Street . . . .	75	19	81	100	281	32	5	7	..	44	325
Leeds Street . . . .	26	8	16	41	85	6	..	1	..	7	92
Bannastre Street . . .	38	7	24	58	127	10	2	5	1	18	145
Midghall Street . . .	33	4	50	46	133	21	1	1	..	23	156
Burlington Street . .	96	11	101	189	397	37	4	3	..	44	441
St. Paul's Square . .	43	20	12	50	125	4	..	2	..	6	131
Harrison Street . . .	■	21	61	117	288	33	10	11	12	66	354
Paul Street . . . . .	16	..	4	49	69	6	..	..	2	8	77
Total . . . . .	713	5	655	1,232	2,605	253	59	65	28	394	3,079

#### HOUSE METERS.

In order to ascertain the consumption under various circumstances, special meters have been attached to houses of different



classes, and the results have been tabulated. The following instances will illustrate the value of the proceeding : —

A meter was fixed at a house in Great Crosshall Street, assessed at £25. The consumption was found to be at the rate of 46 gallons per head per day. An inspection of the fittings was made, and all appeared to be satisfactory, but a closer examination resulted in the discovery that the valve of the water-closet cistern (one of the old form) was out of order, and that water was flowing almost noiselessly down the overflow pipe into the drain. The leak was stopped, a new cistern obtained, and the consumption reduced to  $7\frac{1}{2}$  gallons per head per day.

In Johnson Street, at a lodging-house assessed at £10, the consumption was found to be very variable, ranging from 70 to 7 gallons per head per day. This variation and excess were attributed to the fact that the water-closet was supplied from a common tap, although it was never found to be actually open. The landlord was requested to erect a proper cistern, did so, and the consumption at once became steady at a rate of about 12 gallons per head per day.

#### OFFICE SUPPLIES.

In connection with this subject reference may be made to meters recently attached to three blocks of offices, outside of the test district, viz. the Queen's Insurance Buildings, Walmer Buildings, and Brown's Buildings.

The first readings of the meters showed that water was being used at the following rate : —

Queen's Insurance Buildings, about 80 gallons per head per day. Walmer Buildings, about 23 gallons per head per day. Brown's Buildings, about 32 gallons per head per day.

The undue consumption appears to arise chiefly from the urinals and water-closets. On examination the fittings were found to be generally in good order, but of a very wasteful character.

The presence of the inspectors exercised a wholesome influence, and the consumption has been considerably reduced, but

continues to be far more than it ought to be. The average extending over 41 days has been, —

In Queen's Insurance Building,	21½ per head per day.
In Walmer Buildings,	13    "    "    "    "
In Brown's Buildings,	20½    "    "    "    "

It must be remembered that most of the persons included in this calculation are only day tenants, and consume water at their residences in addition to what is used in their offices.

#### RESULTS OBTAINED IN TEST DISTRICTS.

Having given an outline of the measures adopted for the prevention of waste, it now remains to show their effect on the consumption of water. The following statement gives : —

1st. The quantity used per head, per day, under the old intermitted system of eight to ten hours' daily supply.

2d. The quantity used when the districts were first placed on constant service.

3d. The present consumption with constant service.

The figures are averages of several days.

No. District.	Population.	Former inter- mittent supply	Former constant supply	Present constant supply. Average for week ending Nov 17
1. Henry Edward Street.	2,134	18	35	6.6
2. Charters Street . . . .	2,285	14½	24	13.66
3. Hatton Garden . . . .	2,574	23	40	19.19
4. Blapham Street . . . .	1,540	11½	19	13.37
5. Cookspur Street . . . .	967	22½	38½	14.39
6. Gascoyne Street . . . .	1,534	18½	33	11.46
7. Plumbo Street . . . . .	2,570	31	55	17.28
8. Leeds Street . . . . .	827	17½	45	13.51
9. Banastre Street . . . .	1,924	14½	26	10.27
10. Midghall Street . . . .	1,526	20½	29	10.77
11. Burlington Street . . .	5,798	18½	28	12.85
12. St. Paul's Square . . .	899	24½	37	17.54
13. Harrison Street . . . .	3,399	18½	33	12.77
14. Paul Street . . . . .	838	24	41	10.74
Average . . . . .	• • • • •	19.59	33.55	13.32

The average saving in the districts, as they at present stand, is, therefore,

Gallons per head per day.

From former intermittent service . . . . . 6.27

= 194,407 gals. per day, and 71,000,000 gals. per annum.

From former constant service . . . . . 20.23\*

= 627,251 gals. per day, and 229,000,000 gals. per annum.

#### CONDITION OF THE STREET PIPES.

By closing the stop-cocks on the lead service-pipes, and preventing all use of water in the district, it is evident that any water passing through the meter must be flowing to waste under the streets. This test has been applied in twelve of the districts, with the results stated below :—

District.	Date.	Stop-cocks shut and Taps tied. Lowest reading rate per hour, in gallons.	Rate per head per day.
Henry Edward Street . . . . .	3d February . .	180	2.0
" " . . . . .	25th April . . .	80	.9
Charters Street . . . . .	13th February .	286	2.7
" " . . . . .	23th October .	486	5.0
Hutton Garden . . . . .	2d April . . .	1,140	12.5
" " . . . . .	29th May . . .	750	7.0
" " . . . . .	7th November .	411	3.83
Blapham Street . . . . .	. . . . .	22	0.34
Cockspur Street, reduced district . .	. . . . .	Meter stopped.	Allight.
Gascayne Street . . . . .	17th June . . .	240	3.75
" " . . . . .	28th October	Experiments repeated, but interrupted, and results not satisfactory.	
Plumbe Street . . . . .	14th October .		
Leeds Street . . . . .	16th April . . .	146	4.35
" " . . . . .	14th October .	55	1.6
Banastre Street . . . . .	2d July . . . .	96	1.28
St. Paul's Square . . . . .	11th June . . .	340	9.0
" " half district . . . . .	28th October .	48	2.3
Harrison Street . . . . .	27th August . .	360	2.5
Paul Street . . . . .	17th June . . .	42	1.2

\* The value at 9d. a thousand gals. of water, saved between former intermittent and present constant service, is £2,662 per annum, and between former constant service and present constant service, £8,587 per annum.

## NIGHT READINGS.

Readings of the meters are taken by the night inspectors in the districts where they are engaged, and give excellent indications of the extent of waste by showing what quantity of water is being used at a time when cisterns ought to be full and the inhabitants at rest. Subjoined is a statement of readings at various dates:—

*Water passing through the District Meters between the hours of 1 and 4 o'clock, A. M.*

DISTRICT.	FORMER NIGHT READINGS.		LOWEST NIGHT READINGS.		LATEST NIGHT READINGS. (Special.)	
	Date.	Rate per head per day in gallons.	Date.	Rate per head per day in gallons.	Date.	Rate per head per day in gallons.
1. Henry Edward St.	February	28.0	July .	0.75	Oct. 27	2.7
2. Charters Street . .	"	18.0	. . . .	. . .	" 25	5.5
3. Hatton Garden . .	April 8	28.0	July 5	11.0	" 29	10.0
4. Blispham Street . .	May 16	17.2	" 26	4.5	" 27	5.7
5. Cockspur Street .	June 2	23.7	Aug. 25	4.0	" 23	7.1
6. Gascoyne Street .	" 14	21.7	July 8	3.0	Nov. 23	7.5
7. Plumbs Street . .	May 13	20.0	Oct. 22	10.3	" 20	7.0
8. Leeds Street . . .	June 27	11.6	Aug. 1	3.4	Oct. 28	5.2
9. Banastre Street . .	" 17	10.5	July 4	8.1	" 27	5.2
10. Midghall Street . .	July 7	4.0	Oct. 16	4.7	Nov. 26	2.8
11. Burlington Street .	" 18	18.2	" 10	5.96	Oct. 10	5.9
12. St. Paul's Square .	June 20	18.7	Aug. 15	11.0	Nov. 19	10.7
13. Harrison Street . .	" 18	14.5	Sept. 11	3.3	" 25	5.3
14. Paul Street . . . .	May 21	17.1	" 10	2.9	Oct. 28	3.7

The "rate per head per day" shows what the consumption would be in twenty-four hours, assuming it to continue at the same rate as when the observations were made.

## PRINCIPAL SOURCES OF WASTE.

The several operations described have afforded valuable evidence of the causes of waste, and the most effectual means



preventing it. From the daily records which have been kept of the consumption, the results obtained under various conditions and circumstances can be compared, and any increase or decrease in the quantity used during the day or night may be immediately seen. It has been found that the leakages from street pipes bear only a small proportion to the total waste. Although many of the distributing mains are very old, worn, and corroded, and break at the least disturbance, the number of actual defects discovered in them has been few.

The chief sources of waste have proved to be private pipes and fittings. Nearly all the private piping hitherto examined has been found too light for the ordinary pressure, and often in a very bad condition. Unskilful attempts have been made to repair defects, while joints of imperfect and unsound character, cisterns and taps of faulty construction, and water-closets without proper regulating apparatus, have been very general. After the alterations that have been made in compliance with waste-water notices, there are still in these 14 districts 852 water-closets, and about 2,000 taps which are contrary to the present regulations. There are 275 water-closets supplied by common taps, 239 water-closets supplied by single valves, and 338 by old regulating cisterns. The corporation have at present no power to order the removal of such objectionable fittings except when they are seen to be actually wasting water. In such cases care is taken that the regulations are strictly complied with.

By vigilant inspection a great deal has been done in this direction, and it is mainly to these efforts that the reduction in consumption is due. In the districts where the greatest number of alterations in private pipes and fittings have been made, the minimum consumption has been reached. Henry Edward Street district has been more thoroughly dealt with than any others. 219 taps have been taken out of the cellars of courts and adjoining front houses in favor of self-closing stand-pipes. The result is that the consumption is very low and very steady. For the past three months the average daily quantity used has been at the rate of 8.47 gallons per head, and for the last month the average consumption has been 6 $\frac{3}{4}$  gallons per head

per day. As a contrast to Henry Edward Street, the district known as Plumbe Street shows the increased difficulty of overcoming waste where the same sweeping changes cannot be made. The courts being much fewer, the proportion of renewals effected by the corporation men on private property has been correspondingly smaller. The number of objectionable water-closets here is 139.

It is also to be observed that, in districts containing houses of a better class, and where there are many business premises, as in Plumbe Street and Hatton Garden, the consumption is invariably higher than in a low-class district. A considerable quantity of water is used for trade purposes and for horses, which is included in the consumption per head given in the table, and must be allowed for when a comparison is made.

The stand-pipes do not of themselves appear to have had much influence in diminishing waste. In a district (Paul Street) where the courts were supplied by means of common taps, the average consumption was about the same as in districts where stand-pipes had been erected. The Paul Street district has, within the last month, been similarly treated, and no marked change in the consumption produced, excepting that the variations from day to day are less, which is doubtless owing to the stand-pipe being self-closing, and the waste consequent on a tap being occasionally left open stopped.

#### WASTE-WATER METERS.

About eighteen months ago a plan was prepared, showing the division of the Borough of Liverpool into 300 districts, the whole of the water fittings in each of which were commanded by a single service-main.

It was at that time suggested that if the water in each such main were caused to pass through a meter, the various steps for the systematic reduction of waste might be proceeded with in the most economical and efficient manner. It was believed that when once the districts had been reduced to a proper rate of consumption, that rate could without difficulty be maintained by systematic reading of the meters, and by sending into the

districts in which the consumption had unduly risen the Waste-Water Inspectors, who formerly spent their time equally on good and bad grounds. The cost of the meters would, however, have been very great; and the actual saving capable of being effected by them was not at that time understood.

It was, therefore, decided to try the experiment at first with fourteen districts.

The value of the results has far surpassed the most sanguine expectations, as the figures already quoted show; and it may be safely stated that such results could not have been obtained without the meters.

The great cost of the ordinary piston meters, and the fact that, although they register the total quantities between any two observations, they do not register the quantities passing through the mains at any required time when an observation is not being made, induced the engineer to give his attention to the design of a meter which could be constructed at a small cost, and which would fulfil the special objects of a waste-water meter.

The four-inch meter designed for this purpose has the following properties: —

1. It can be constructed for less than one fifth the price of the piston meters at present in use.

2. It can be fixed, including the cover, for less than one seventh the cost of chambers and fixing for the ordinary meter.

3. It is absolutely self-registering; that is, it registers on a diagram the quantity of water flowing through the main at every moment instead of the total quantity between any two observations. The minimum night reading is such, a diagram is especially useful, as it indicates almost exactly the quantity of waste. Such information can only be obtained from an ordinary meter — and then but indifferently — by watching and counting the strokes during the night.

4. It distinguishes the variable waste due to taps and other water-fittings left running from the comparatively constant waste due to leaks in pipes.

5. A single diagram may be taken for any required length of time up to seven days, and when applied to a district of



1,000 to 2,000 persons it indicates distinctly the closing and opening of every separate tap. It is, moreover, equally sensitive at high and low velocities.

6. It may be safely stated that its accuracy is much less liable to change than that of a meter constructed on the principle of direct quantitative measurements, because it depends chiefly upon the accuracy of the dimensions of certain fixed parts, and not upon the maintenance of the accuracy of the position of moving parts, or upon the condition of cup-leathers, or other packing, as is usually the case.

7. The meter does not present the usual and objectionable obstruction to the motion of the water, the reduction of pressure probably never exceeding four or five ounces per square inch.

#### ADDITIONAL DISTRICTS UNDER TEST.

Two districts have been commanded by waste-water meters for a sufficient time to show the value of their indications in practice. One of these includes the greater part of the Exchange Buildings, Hackings Hey, Williams Street, Temple Hey, and Tithebarn Street, between Moorfields and Exchange Street. The district consists principally of offices, and contains a population of 263 residents and 1,110 non-residents, who consume water elsewhere. Total, 1,373.

The diagram, being left on for three days before any intimation had been given to the consumers, gave the following results : —

	Gallons per head per day (Constant service.)	Average rate during the night.
Oct. 4 and 5 . . .	58.4 . . .	50.4
" 5 and 6 . . .	59.5 . . .	52.44
" 7 and 8 . . .	59.7 . . .	50
Average,	59.2	50.95

After the census of the district had been taken, and some superficial repairs made, the day reading came down to twenty-six, and the night reading to fifteen, gals. per head. It is

for a moment to be supposed that this great change was brought about by the few repairs made; on the contrary, there is every reason to believe that it was due chiefly to the greater care exercised by keepers and others in closing taps at night, after the visits of the Waste-Water Inspectors. Indeed, the details of the diagrams confirm this view. The saving in this case would probably not continue long, unless regulating cisterns were substituted for the present apparatus.

#### OPERATIONS OUTSIDE THE TEST DISTRICTS.

When the re-piping work had been completed in the fourteen districts mentioned, it was necessary, in order to avoid breaking up the staff, to employ the men in a similar manner in districts unprovided with meters. This course is by no means satisfactory, as the result of the operation cannot be tested. The engineer, therefore, strongly recommends that meters be applied at once to a sufficient number more of the service mains to avoid going over the grounds twice.

#### CONCLUSIONS.

The average domestic consumption of water in Liverpool under the intermittent system is about twenty-four gallons per head per day.\* In the first fourteen districts of low-class property that average was 19.59, and yet constant supply has been given, and the consumption reduced to 13.32, or more than ten below the general average.

On the other hand the tests on office property have shown that the consumption is much above the average, notwithstanding the fact that more than three fourths of the people use water elsewhere. In the Exchange district already mentioned, the average intermittent consumption was about six gallons above the general average, and was easily converted to constant service, and reduced to only one above that average.

Isolated meter tests, conducted in districts containing a better class of dwelling-houses, have indicated that the consumption

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\* This includes all water used from the service mains, except that sold by meter measurements for trade purposes.

is equal to about the general average, and this might reasonably be expected from the averages in the two first classes.

Hitherto, then, the results have been eminently satisfactory, and there is every indication that as different classes of property are reached, they will become even more so, although, until the proposed Parliamentary powers are obtained, there must always be a very large amount of waste, and a great expenditure in only partially successful efforts to keep it down.

(Signed)

GEORGE F. DEACON,

*Borough and Water Engineer.*

WATER ENGINEER'S DEPARTMENT,

Nov. 11, 1878.

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In regard to the financial results of this system we quote further as follows: "The result of these tests in fourteen districts of Liverpool was a saving, wholly due to inspection, repairs, and renewals, of 627,251 gallons daily, or 229,000,400 gallons yearly, which, estimated at the rate of the cost of water, say ninepence a thousand gallons, amounted to £8,587 sterling per annum."

It must be borne in mind, that the above tables show the saving in only fourteen districts of that city, including a population of less than 30,000 out of 500,000, the latest population of Liverpool.

It is striking to observe in this valuable report how the various causes of waste from precisely the same defects are detailed in the same way as have been set forth in Reports made to this Board; and of course if the same remedies were applied we may expect the same results. It will be noticed that their daily service was reduced from an average of  $33\frac{55}{100}$  gallons per head to  $13\frac{82}{100}$  gallons, while their nightly discharge was reduced from  $17\frac{58}{100}$  gallons per head to  $4\frac{84}{100}$  gallons per head.

# REPORT

OF

## THE WATER REGISTRAR.

WATER REGISTRAR'S OFFICE,  
CAMBRIDGE, Dec. 1, 1875.

*To the Cambridge Water Board:*

GENTLEMEN, — Herein is respectfully presented the Annual Report of the Water Registrar for the year ending Nov. 30, 1875, showing a statement of the receipts and expenditures for the year, together with such other matters in the department as are deemed worthy of notice.

### Receipts.

Water Rates . . . . .	\$138,880 37
Supply pipe, laying and repairing . . . . .	8,164 21
Fines, off and on water . . . . .	275 00
Rent of house, pipe yard . . . . .	150 00
	<u>\$147,469 58</u>

All of which has been paid to the City Treasurer.

The decrease in the amount of income for the  
financial year from the previous year is . . . \$22,131 54

Statement showing the amounts due the City Nov. 30, 1875,  
on account of Water Works : —

Amount due on supply account from City . . . . .	\$2,681 19
Amount due on supply account from sundry parties . . . . .	8,712 37
Amount carried forward . . . . .	<u>\$11,393 56</u>



Amount brought forward . . . . .	\$11,393 56
Amount due on Water Rates from City, 1873 . . . . .	3,929 04
“ “ “ “ “ “ 1874 . . . . .	6,804 60
“ “ “ “ “ “ 1875 . . . . .	27,915 90
Amount due on Water Rates from sundry parties, . . . . .	5,791 93
Total . . . . .	<u>\$55,835 03</u>

**Expenditures.**

The expenditures for the care and management of the works for the year ending Nov. 30, 1875, have been as follows : —

For care and repairs . . . . .	\$19,300 82
“ pumping service . . . . .	3,861 62
“ office expense . . . . .	5,489 33
Total amount . . . . .	<u>\$28,651 77</u>

The expenditures on the extension of the works

for the year ending Nov. 30, 1875, were . \$153,170 67

The expenditures on supply account were . 12,498 53

Statement of the yearly revenue received from water rates since the purchase of the works by the City : —

From April 28, 1865, to Dec. 1, 1865 . . . . .	\$32,367	19
“ Dec. 1, 1865, “ “ 1866 . . . . .	40,073	27
“ “ 1866, “ “ 1867 . . . . .	52,733	62
“ “ 1867, “ “ 1868 . . . . .	63,747	42
“ “ 1868, “ “ 1869 . . . . .	76,149	30
“ “ 1869, “ “ 1870 . . . . .	92,606	95
“ “ 1870, “ “ 1871 . . . . .	111,782	65
“ “ 1871, “ “ 1872 . . . . .	127,201	30
“ “ 1872, “ “ 1873 . . . . .	146,117	32
“ “ 1873, “ “ 1874 . . . . .	153,634	27
“ “ 1874, “ “ 1875 . . . . .	138,880	37

In the last report there were remaining off for

non-payment of rates . . . . .	13
Since shut of . . . . .	254
	<u>2 67</u>
Let on . . . . .	1 37
Still remaining off . . . . .	<u>1 30</u>

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, ETC., SUPPLIED  
WITH FRESH POND WATER TO DEC. 1, 1875.

9,770 Families.	4 Paint shops.
1,071 Hand hose.	4 Iron foundries.
671 Private stables.	4 Book binderies.
240 Stores.	4 Photograph rooms.
97 Stationary engines.	4 Slaughter houses.
43 Saloons.	4 Cooper shops.
41 Offices.	4 Post offices.
35 Meat markets.	3 Cigar manufactories.
33 Barber shops.	3 Steam railroad depots.
30 Schoolhouses.	3 Steam railroads.
26 Boarding-houses.	3 Box manufactories.
22 Bakehouses.	3 I. O. O. F. halls.
22 Greenhouses.	3 Aquariums.
20 Blacksmith shops.	3 Laundries.
16 College buildings.	3 Lard works.
15 Soap manufactories.	2 Glass works.
15 Fish markets.	2 Confectionery manufactories.
14 Public halls.	2 Organ factories.
12 Churches.	2 Tinware manufactories.
10 Livery stables.	2 Club stables.
10 Coal wharves.	2 Tallow factories.
9 Billiard halls.	2 Private schools.
8 Lodging-houses.	2 Laboratories.
8 Horse-railroad stables.	2 Masonic halls.
8 Club rooms.	2 City stables.
8 Banks.	2 Libraries.
7 Machine shops.	2 Brush manufactories.
7 Engine-houses.	2 Stereotype foundries.
7 Printing offices.	2 Boiler manufactories.
6 Furniture manufactories.	2 Spring-bed manufactories.
6 Lumber wharves.	2 Sausage manufactories.
6 Cow pastures.	2 Potteries.
6 Stone yards.	1 Cider refinery.
6 Marble works.	1 Chemical works.
5 Carpenters' shops.	1 Ice tool manufactory.
5 Police stations.	1 Coffin manufactory.
5 Harness shops.	1 Fruit preserving company.
5 Planing mills.	1 Cattle yard.
3 Nurseries.	1 Almshouse.
5 Carriage manufactories.	1 Brass foundry.
5 Plumber shops.	1 Botanic garden.
5 Bacon works.	1 Brickyard.
4 Public houses.	1 Currier shop.

1 City hall.	1 Sugar refinery.
1 K. of P. hall.	1 Swine yard.
1 City wharf.	1 Grapery.
1 Cemetery	1 Bleachery.
1 Drain pipe manufactory.	1 Car wheel company.
1 Distillery.	1 Frame and moulding manufac- tory.
1 G. A. R. Hall.	1 Oiled hat and clothing manu- factory.
1 Gas works.	1 Shoe manufactory.
1 Gymnasium.	1 Freight depot.
1 House of Correction.	1 Conservatory of music.
1 Lead pipe works	1 Rubber hose manufactory.
1 Museum of Comparative Zool- ogy.	1 Mat manufactory.
1 Ice company.	1 Cheese factory.
1 Hardware manufactory.	1 Net and twine manufactory.
1 Paper collar manufactory.	
1 Rolling mill.	

## STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER TAKERS IN THE CITY OF CAMBRIDGE DEC. 1, 1875.

11,384 Faucets.	440 Slop closets.
3,047 Water-closets.	88 Garden hydrants for hand hose
2,876 Wash-bowls.	78 Yard hydrants for family use.
1,458 Bath-tubs.	13 Private fountains.
1,454 Wash-tubs.	9 Tumbler washers.

During the year 13 meters have been applied and 4 removed from the premises of water takers, making the total number now in use 93. They are attached to a variety of manufacturing establishments, as follows:—

TABLE.

WHERE ATTACHED.	SIZE OF METERS.						
	½ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.
A. H. Hews & Co. . . . .					1		
A. B. Furlong . . . . .			1				
American Net & Twine Co. . . . .			1				
Botanic Garden . . . . .			1				
Blake Hose Association . . . . .		1					
Braman, Shaw & Co. . . . .				1			
Boston Nut & Bolt Co. . . . .			1				
Boston & Albany R. R. . . . .					1		
Boston & Lowe R. R. . . . .			1		3		
Boston Chemical Works . . . . .					1		
Boston Rolling Mill . . . . .					1		
Boston Stamping & Manufacturing Co. . . . .			1				
Boston Car Wheel Co. . . . .		1					
Beal & Hooper . . . . .					1		
B. P. Clark & Co. . . . .				1			
City of Cambridge . . . . .					1		



TABLE, — Continued.

WHERE ATTACHED.	SIZE OF METERS.						
	$\frac{1}{8}$ in.	$\frac{1}{4}$ in.	1 in.	1½ in.	2 in.	3 in.	4 in.
C. L. Jones . . . . .			1				
C. B. French . . . . .			1				
Cambridge Gas Light Co. . . . .		1					
Curtis Davis . . . . .				1			
Dover Stamping Co. . . . .	1	1					
D. G. Pratt . . . . .			1				
Doe & Hunnewell . . . . .				1			
Fitchburg R. R. . . . .					1		
F. Draper & Co. . . . .		1					
F. Geldowsky . . . . .				1			
G. G. Page & Co. . . . .					1		
George Woods & Co. . . . .				1			
George O. Ladd & Co. . . . .			1				
House of Correction . . . . .					1		
H. O. Houghton & Co. . . . .			1				
Henry Ibayer & Co. . . . .					1		
Hancock & Greely . . . . .				1			
H. M. Clark . . . . .		1					
H. M. Wyeth . . . . .			1				
Harvard College . . . . .			3	2			
Holyoke House . . . . .					1		
J. P. Squire & Co. . . . .		1			1		
John Wilson & Son . . . . .			1				
J. D. Osborn Estate . . . . .					1		
John Reardon & Sons . . . . .			1				
James C. Davis . . . . .			1				
Leonard Cox . . . . .		1					
Little, Brown & Co. . . . .			1				
Low & Knight . . . . .				1			
Mt. Auburn Cemetery . . . . .				1	1		
Mason & Hamlin . . . . .		1	2				
Middlesex Bleachery . . . . .		1					
Memorial Hall . . . . .					1		
New England Glass Co. . . . .					1		
New England Brick Co. . . . .					2		
O. S. Bullock . . . . .			1				
Oleomargarine Factory . . . . .		1					
Prospect House . . . . .				1			
Revere Sugar Refinery . . . . .					1		
Reversible Collar Co. . . . .					1		
Russell & Dimick . . . . .		1					
Sortwell & Co. . . . .					1		
S. M. Coffin . . . . .					1		
St. Mary's Church . . . . .					1		
Theodore Downing . . . . .			1				
Union Glass Co. . . . .		1	2				
Union Railway Co. . . . .		4	1	2	3		
Woodbury & Co. . . . .					1		
Welch, Bigelow & Co. . . . .		1					
Whittemore & Hale . . . . .			2				
Walworth Manufacturing Co. . . . .				1			

In compliance with the City Ordinance all buildings supplied with Fresh Pond water have been visited during the year.

Respectfully submitted.

A. F. FIFIELD,  
Water Registrar.

# REPORT

## OF THE

### SUPERINTENDENT OF THE WATER WORKS.

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*To the Cambridge Water Board:*

GENTLEMEN, — In obedience to an Ordinance of the City I have the honor to present to you the Tenth Annual Report.

#### **Pond.**

The water in the pond has been kept low the present season, in order to afford an opportunity for dredging and cleaning up the borders of the pond, the work on which is now rapidly progressing.

A conduit has also been built connecting Spy and Little Ponds and Wellington Brook with Fresh Pond. These ponds are kept filled against an emergency, when the conduit can be opened and the level of Fresh Pond can be raised.

#### **Engine-House.**

The grounds around the engine-house have been graded up to a proper level with rich soil from the pond, and are all prepared for grassing over in the spring.

We have now a perfect duplicated system of pumping power, consisting of two of H. R. Worthington's Duplex Engines, each of a daily pumping capacity of 5,000,000 gallons, which, together with the boilers for each, are in complete working order. The conduit leading out into the pond to deep water, also the two force mains from the engine-house to the reservoir, are in perfect order, no repairs being required on either during the year. These force mains are so connected with valves that

we can pump either into the stand-pipe, the reservoir, or directly into the distributing pipes, as occasion may require.

The engines, in the past year, have run . 4,351 hours 45 min.

A daily average of . . . . . 11 " 55 "

There have been consumed . . . 1,780,900 pounds of coal.

A daily average of . . . . . 4,879 " "

The engines have made in the year 3,307,490 revolutions.

A daily average of . . . . . 9,062 "

They have pumped during the year 992,247,000 gals. of water.

A daily average of . . . . . 2,718,485 " "

The monthly supply and daily average are shown in the following table, covering 52 weeks:—

	Days.	Total Gallons per Month.	Daily Average per month.
December, 1874 . . . . .	28	67,701,600	2,115,675
January, 1875 . . . . .	31	86,186,100	2,780,197
February, " . . . . .	28	111,794,400	3,992,657
March, " . . . . .	28	113,078,900	4,088,353
April, " . . . . .	30	98,728,500	3,220,814
May, " . . . . .	28	78,483,300	2,802,975
June, " . . . . .	28	86,864,100	3,102,214
July, " . . . . .	31	110,945,700	3,169,877
August, " . . . . .	28	65,083,200	2,324,400
September, " . . . . .	28	60,283,800	2,152,992
October, " . . . . .	31	57,288,300	2,046,010
November, " . . . . .	28	55,814,100	1,993,360

#### Reservoirs.

The reservoirs are in good order, and have had a very slight amount of repairs during the year.

#### Distribution Pipes.

On Harvard Street the 4-inch pipe has been removed, and a 12 and 10 inch pipe laid in its place, from Hancock Street east-

erly to the junction of Main Street, and all the side pipes have been connected with the same, giving us not only a greater supply of water for domestic purposes but for the extinguishment of fire. In addition to the above, 10 lines of small main pipes have been lowered that were frozen last winter; also a large number of supply pipes, to prevent, if possible, the experience of the past season.

#### **Hydrants.**

71 Hydrants have been set the past year. Among this number are 15 of the Pattee & Perkins' pattern, which are very satisfactory in their working to the Chief Engineer of the Fire Department, who has the locating of all these hydrants, under the direction of the proper authority.

#### **Drinking Fountains.**

One drinking fountain has been added during the year, making the total number sixteen. They are located as follows:—

North Avenue, corner of Walden Street.

North Avenue, opposite Mechanics Exchange.

Cambridge Common.

Harvard Square, opposite the store of Alfred Wood.

Brattle Square, opposite Brewer's Block.

Atwood's Corner, junction Cambridge and Hampshire Streets.

Cambridge Street, corner Fifth Street.

Bridge Street, junction Cambridge Street.

Third Street, between Main Street and Broadway.

Hampshire Street, junction Broadway.

Broadway, corner Norfolk Street.

Lafayette Square, front of Universalist Church.

Central Square, opp. the store of D. U. Chamberlin & Co.

Central Square, opposite the store of J. A. Holmes & Co.

Fort Washington.

Putnam Avenue, corner Pearl Street.

#### **Stand-pipes for Street Watering.**

Two stand-pipes for street watering have been erected the



past season, making the total number now in use thirty-five, located as follows : —

Main Street, west of Quincy Street.

North Avenue, near the Common.

“ “ “ Forest Street.

“ “ “ Beech Street.

“ “ “ Day Street.

Concord Avenue, junction Garden Street.

Near University Press.

Inman Street, near Broadway.

Broadway, corner Winsor Street.

Columbia Street, near Austin Street.

Green Street, near Western Avenue.

Cambridge Street, at Atwood's Corner.

Cambridge Street, near Warren Street.

Gore Street, opposite Schoolhouse.

Otis Street, near Third Street.

Junction Bridge and Cambridge Streets.

Fifth Street, near Thorndike Street.

North Avenue, near Shepard Street.

Dana Street, corner Chatham Street.

Brattle Street, corner Sparks Street.

Broadway, corner Sixth Street.

Dublin Street, near Fitchburg Railroad.

Broadway, near Third Street.

Western Avenue, near Howard Street.

Third Street, near Rogers Street.

Main Street, near Portland Street.

Magazine Street, opposite Warland Street.

Main Street, near Hancock Street.

Kirkland Street, near Quincy Street.

Brattle Street, near Fayerweather Street.

Brattle Street, near Fresh Pond Lane.

Cambridge Street, near Winsor Street.

Mt. Auburn Street, near Athens Street.

North Avenue, near Spruce Street.

Brookline Street, corner Putnam Avenue.

Broadway, junction Hampshire Street.

## Service Pipes.

Diameter in Inches.	Number of Pipes.	Length in Feet.	TOTALS.	
			Number of Pipes.	Length in Feet.
2	14	1,011	14	1,011
1½	12	1,021	12	1,021
1½	..	541	..	541
1	19	1,868	19	1,868
¾	289	23,204	289	23,204
Aggregate . . . . .			334	27,645

The total number of supply pipes is 6,570.

STATEMENT OF LOCATION, SIZE, AND NUMBER OF FEET OF  
PIPE LAID IN 1875.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Athens . . . . .	4	50
Berkshire . . . . .	4	162
Brighton . . . . .	8	471
Berkshire Place . . . . .	4	170
Brattle Square . . . . .	6	120
Beacon . . . . .	6	275
Belmont . . . . .	4	108
Beckett Court . . . . .	4	100
Chestnut . . . . .	6	264
Crescent Avenue . . . . .	6	96
Clinton . . . . .	6	25
Clinton . . . . .	4	540
Chestnut . . . . .	4	180
Creek . . . . .	4	60
Dana . . . . .	4	590
Dunster . . . . .	6	320
Dunster . . . . .	4	80
Dunster . . . . .	3	56
Elliot . . . . .	6	494
Florence . . . . .	4	17
Florence . . . . .	8	200
Forest . . . . .	6	12
Front . . . . .	20	100
Green . . . . .	20	4,411
Green . . . . .	6	104
Greenough Avenue . . . . .	4	172
Harris . . . . .	6	13
Hampshire . . . . .	6	25

STATEMENT OF LOCATION, ETC. — *Continued.*

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
. . . . .	4	735
. . . . .	12	1,751
. . . . .	10	4,088
. . . . .	6	200
. . . . .	4	150
. . . . .	6	10
. . . . .	4	388
venue . . . . .	12	350
venue . . . . .	10	400
venue . . . . .	8	500
venue . . . . .	6	60
. . . . .	6	50
. . . . .	4	367
Yard . . . . .	4	25
. . . . .	6	110
. . . . .	6	246
all . . . . .	4	60
. . . . .	4	12
. . . . .	6	780
. . . . .	6	140
. . . . .	6	10
. . . . .	4	388
. . . . .	20	470
. . . . .	6	50
. . . . .	6	220
. . . . .	4	60
. . . . .	4	400
. . . . .	20	248
. . . . .	6	25
. . . . .	12	690
. . . . .	6	16
nue . . . . .	16	2,713
nue . . . . .	6	150
nue . . . . .	4	25
. . . . .	4	76
. . . . .	6	250
. . . . .	4	965
nue . . . . .	24	200
. . . . .	4	80
. . . . .	6	500
. . . . .	4	463
enue . . . . .	6	192
. . . . .	6	402
. . . . .	6	212
. . . . .	6	300
. . . . .	6	252
. . . . .	4	500
. . . . .	20	220
. . . . .	6	25
. . . . .	20	1,083
. . . . .	6	80
. . . . .	6	620
. . . . .	4	500
. . . . .	4	204
enue . . . . .	6	144
. . . . .	6	600



## GATES.

IN WHAT STREET.	Diameter in Inches.	Number.
Brattle Square . . . . .	6	1
Berkshire . . . . .	4	1
Berkshire Place . . . . .	4	1
Beacon . . . . .	6	1
Brighton . . . . .	4	2
Beckett Court . . . . .	4	1
Chestnut . . . . .	6	1
Clinton . . . . .	4	1
Dana . . . . .	6	1
Dana . . . . .	4	8
Dunster . . . . .	6	1
Dunster . . . . .	4	2
Eliot . . . . .	4	2
Eliot . . . . .	6	1
Front . . . . .	12	1
Front . . . . .	6	1
Florence . . . . .	4	1
Greenough Avenue . . . . .	4	1
Green . . . . .	20	4
Green . . . . .	6	10
Harris . . . . .	4	3
Harvard . . . . .	12	3
Harvard . . . . .	10	7
Harvard . . . . .	6	12
Harvard . . . . .	4	6
Hampshire . . . . .	6	1
Lee . . . . .	4	1
Lowell Railroad Yard . . . . .	4	1
Lake View Avenue . . . . .	12	1
Lake View Avenue . . . . .	6	1
Market . . . . .	4	1
Main . . . . .	6	2
Main . . . . .	4	1
Magazine . . . . .	4	1
Mount Auburn . . . . .	6	1
Mount Auburn . . . . .	4	1
Moore . . . . .	6	1
Magazine . . . . .	6	1
Memorial Hall . . . . .	4	1
Norfolk . . . . .	6	1
Osborn . . . . .	20	1
Orchard . . . . .	4	1
Portland . . . . .	6	3
Putnam Avenue . . . . .	16	4
Putnam Avenue . . . . .	6	8
Putnam Avenue . . . . .	4	3
Pleasant . . . . .	4	1
Portland . . . . .	12	1
Pearl . . . . .	6	1
Quincy . . . . .	6	1
Richdale Avenue . . . . .	6	1
Raymond . . . . .	6	1
Regent . . . . .	6	1

GATES, — continued.

In what Street.	Diameter in Inches.	Number.
. . . . .	6	2
ol . . . . .	6	1
y . . . . .	4	1
l . . . . .	6	1
l . . . . .	4	2
bridge . . . . .	4	1
am . . . . .	4	1
or . . . . .	4	1
en . . . . .	6	1

BLOW-OFF PIPES.

In what Street.	Diameter in Inches.	Number.
ton . . . . .	6	2
le Square . . . . .	6	1
on . . . . .	1½	1
ont . . . . .	1½	1
shire Place . . . . .	1½	1
tnut . . . . .	1½	1
. . . . .	1½	1
. . . . .	6	1
nce . . . . .	1½	1
nough Avenue . . . . .	1½	1
. . . . .	6	7
ard . . . . .	6	8
azine . . . . .	6	1
gomery . . . . .	1½	1
. . . . .	6	1
lc . . . . .	1½	1
outh . . . . .	1½	1
am Avenue . . . . .	6	2
and . . . . .	6	1
lale Avenue . . . . .	1½	1
l . . . . .	1½	1
. . . . .	6	1

RECAPITULATION.

0 feet . . . . .	24-inch.
5 “ . . . . .	20 “
3 “ . . . . .	16 “
1 “ . . . . .	12 “
3 “ . . . . .	10 “
1 “ . . . . .	8 “
1 “ . . . . .	6 “
7 “ . . . . .	4 “
3 “ . . . . .	3 “



2-inch couplings . . . . .	30	1 X $\frac{3}{4}$ -inch crosses . . . . .	8
$1\frac{1}{2}$ " " . . . . .	20	$\frac{3}{4}$ " " . . . . .	6
$1\frac{1}{4}$ " " . . . . .	6	$\frac{3}{4}$ -inch socket ends . . . . .	100
1 " " . . . . .	100	Garden hydrants . . . . .	2
$\frac{3}{4}$ " " . . . . .	50	2-inch nipples . . . . .	4
$\frac{1}{2}$ " " . . . . .	200	$1\frac{1}{4}$ " " . . . . .	2
1-inch air chambers . . . . .	10	$1\frac{1}{2}$ " " . . . . .	20
$\frac{3}{4}$ " " " . . . . .	50	1 " " . . . . .	13
$\frac{1}{2}$ " " " . . . . .	150	$\frac{3}{4}$ " " . . . . .	50
3 " unions . . . . .	4	$\frac{1}{2}$ " " . . . . .	25
$1\frac{1}{2}$ " " . . . . .	12	2 " plugs . . . . .	4
$1\frac{1}{4}$ " " . . . . .	10	$1\frac{1}{4}$ " " . . . . .	6
" " . . . . .	4	$1\frac{1}{2}$ " " . . . . .	5
" " . . . . .	20	1 " " . . . . .	6
" " . . . . .	6	$\frac{3}{4}$ " " . . . . .	10
" clips . . . . .	80	$\frac{1}{2}$ " " . . . . .	6
" " . . . . .	20	2 X $1\frac{1}{4}$ -inch bushings . . . . .	8
" " . . . . .	12	2 X $1\frac{1}{2}$ " " . . . . .	10
" crosses . . . . .	12	2 X 1 " " . . . . .	6
X $1\frac{1}{4}$ -inch crosses . . . . .	6	2 X $\frac{3}{4}$ " " . . . . .	8
X $1\frac{1}{2}$ " " . . . . .	12	$1\frac{1}{2}$ X $1\frac{1}{4}$ " " . . . . .	5
X 1 " " . . . . .	6	$1\frac{1}{2}$ X 1 " " . . . . .	8
$1\frac{1}{2}$ " " . . . . .	6	$1\frac{1}{2}$ X $\frac{3}{4}$ " " . . . . .	6
$1\frac{1}{4}$ X $1\frac{1}{4}$ " " . . . . .	5	$1\frac{1}{4}$ X 1 " " . . . . .	6
$1\frac{1}{2}$ X 1 " " . . . . .	8	$1\frac{1}{2}$ X $\frac{3}{4}$ " " . . . . .	5
$1\frac{1}{4}$ X $\frac{3}{4}$ " " . . . . .	12	1 X $\frac{3}{4}$ " " . . . . .	10
$1\frac{1}{2}$ " " . . . . .	12	$\frac{3}{4}$ X $\frac{1}{2}$ " " . . . . .	12
$1\frac{1}{4}$ X 1 " " . . . . .	10	1-inch lock-nuts . . . . .	40
$1\frac{1}{2}$ X $\frac{3}{4}$ " " . . . . .	10	$\frac{3}{4}$ " " . . . . .	40
1 " " . . . . .	6	$\frac{1}{2}$ " " . . . . .	20

## Miscellaneous.

4 Flush hydrants.	1 Large hand-pump.
100 Tons old junk.	1 Thawing stove.
4 Wagons.	1 Large boom derrick.
2 Hand-carts.	2 Small derricks.
2 Horses.	2 $\frac{1}{2}$ Tons lead.
3 Sets harness.	1 Yard rubber packing.
1 Pung.	

## Stock at Pipe Yard.

33-inch pipe . . . . .	2 lengths.	12-inch pipe . . . . .	8 lengths.
36 " " . . . . .	26 "	10 " " . . . . .	9 "
30 " " . . . . .	25 "	8 " " . . . . .	10 "
24 " " . . . . .	23 "	6 " " . . . . .	2 "
16 " " . . . . .	67 "	4 " " . . . . .	88 "



2-inch couplings . . . . .	80	1 × ¾-inch crosses . . . . .	6
1½ " " . . . . .	20	¾ " " . . . . .	6
1½ " " . . . . .	6	¾-inch socket ends . . . . .	100
1 " " . . . . .	100	Garden hydrants . . . . .	2
¾ " " . . . . .	50	2-inch nipples . . . . .	4
½ " " . . . . .	200	1½ " " . . . . .	2
1-inch air chambers . . . . .	10	1½ " " . . . . .	20
¾ " " " . . . . .	50	1 " " . . . . .	13
½ " " " . . . . .	150	¾ " " . . . . .	50
2 " unions . . . . .	4	½ " " . . . . .	25
1½ " " . . . . .	12	2 " plugs . . . . .	4
1½ " " . . . . .	10	1½ " " . . . . .	6
1 " " . . . . .	4	1½ " " . . . . .	5
¾ " " . . . . .	20	1 " " . . . . .	6
½ " " . . . . .	6	¾ " " . . . . .	10
1 " clips . . . . .	30	½ " " . . . . .	6
¾ " " . . . . .	20	2 × 1½-inch bushings . . . . .	8
½ " " . . . . .	12	2 × 1½ " " . . . . .	10
2 " crosses . . . . .	12	2 × 1 " " . . . . .	6
2 × 1½-inch crosses . . . . .	6	2 × ¾ " " . . . . .	8
2 × 1½ " " . . . . .	12	1½ × 1½ " " . . . . .	5
2 × 1 " " . . . . .	6	1½ × 1 " " . . . . .	8
1½ " " . . . . .	6	1½ × ¾ " " . . . . .	6
1½ × 1½ " " . . . . .	5	1½ × 1 " " . . . . .	6
1½ × 1 " " . . . . .	8	1½ × ¾ " " . . . . .	5
1½ × ¾ " " . . . . .	12	1 × ¾ " " . . . . .	10
1½ " " . . . . .	12	¾ × ½ " " . . . . .	12
1½ × 1 " " . . . . .	10	1-inch lock-nuts . . . . .	40
1½ × ¾ " " . . . . .	10	¾ " " . . . . .	40
1 " " . . . . .	6	½ " " . . . . .	20

Miscellaneous.

4 Flush hydrants.	1 Large hand-pump.
100 Tons old junk.	1 Thawing stove.
4 Wagons.	1 Large boom derrick.
2 Hand-carts.	2 Small derricks.
2 Horses.	2½ Tons lead.
3 Sets harness.	1 Yard rubber packing.
1 Pung.	

Stock at Pipe Yard.

48-inch pipe . . . . .	2 lengths.	12-inch pipe . . . . .	5 lengths.
36 " " . . . . .	26 "	10 " " . . . . .	8 "
30 " " . . . . .	25 "	8 " " . . . . .	10 "
24 " " . . . . .	23 "	6 " " . . . . .	2 "
16 " " . . . . .	67 "	4 " " . . . . .	38 "

20-inch cross . . . . .	1	20 X 10-inch tee . . . . .	1
20 X 12-inch cross . . . . .	1	20 X 6 " tees . . . . .	8
20 X 10 " " . . . . .	1	12 " " . . . . .	3
16 X 12 " crosses . . . . .	2	12 X 6 " " . . . . .	5
12 " " . . . . .	2	12 X 8 " tee . . . . .	1
12 X 10 " " . . . . .	3	10 X 4 " tees . . . . .	3
12 X 6 " " . . . . .	7	8 X 6 " tee . . . . .	1
12 X 4 " " . . . . .	3	6 X 6 " tees . . . . .	3
10 X 8 " cross . . . . .	1	6 X 4 " " . . . . .	4
10 X 6 " crosses . . . . .	7	4 " " . . . . .	4
8 X 4 " " . . . . .	2	24 X 10 " reducer . . . . .	1
6 X 4 " " . . . . .	11	20 X 12 " reducers . . . . .	2
4 " " . . . . .	20	20 X 8 " reducer . . . . .	1
30-inch sleeves . . . . .	2	16 X 6 " reducers . . . . .	2
24 " " . . . . .	7	12 X 8 " reducer . . . . .	1
20 " " . . . . .	4	10 X 6 " " . . . . .	1
18 " " . . . . .	6	8 X 6 " " . . . . .	1
12 " " . . . . .	10	6 X 4 " reducers . . . . .	3
10 " " . . . . .	2	4 X 8 " " . . . . .	6
8 " " . . . . .	2	20-inch caps . . . . .	3
6 " " . . . . .	2	12 " " . . . . .	12
4 " " . . . . .	3	6 " " . . . . .	4
3 " " . . . . .	12	4 " " . . . . .	7
24 " clamp sleeves . . . . .	5	10 " off-sets . . . . .	8
12 " " " . . . . .	5	6 " " . . . . .	18
10 " " " . . . . .	6	4 " " . . . . .	4
8 " " " . . . . .	6	12 " gates . . . . .	4
6 " " " . . . . .	5	10 " gate . . . . .	1
4 " " " . . . . .	5	8 " gates . . . . .	2
3 " " sleeve . . . . .	1	6 " " . . . . .	4
30 " $\frac{1}{2}$ bend . . . . .	1	4 " " . . . . .	3
24 " $\frac{1}{4}$ " . . . . .	1	3 " " . . . . .	3
24 " $\frac{1}{8}$ " . . . . .	2	4 " meter . . . . .	1
20 " $\frac{1}{8}$ " . . . . .	1	1 $\frac{1}{2}$ " " . . . . .	1
16 " $\frac{1}{8}$ bends . . . . .	2	1 " meters . . . . .	2
12 " $\frac{1}{8}$ " . . . . .	2	$\frac{3}{4}$ " meter . . . . .	1
10 " $\frac{1}{8}$ " . . . . .	14	Large frames and covers . . . . .	4
8 " bend . . . . .	1	Frames and covers . . . . .	4
6 " $\frac{1}{8}$ bends . . . . .	5	Small frames and covers . . . . .	6
6 " " to go over or under		24-inch elbow . . . . .	1
drains . . . . .	20	10 " elbows . . . . .	2
20 X 6-inch blow-offs . . . . .	8	6 " " . . . . .	19
16 X 6 " " . . . . .	2	24 " Y branch . . . . .	1
12 X 6 " " . . . . .	1	12 " " . . . . .	1
34 " tee . . . . .	1	24 " check-valves . . . . .	2
24 X 8 " " . . . . .	1	Stand-pipes for shut-off cocks . . . . .	43
24 X 6 " tees . . . . .	3	One dwelling-house for teamster.	
20 " " . . . . .	3	One stable and shed.	
20 X 12 " tee . . . . .	1		



**Stock at Engine House.**

100 tons coal.	1 set grate bars.
1 bale cotton waste.	150 fire brick.
20 pounds Martin's packing.	1 barrel kaolin.
20 pounds hemp packing.	1 barrel pipe clay.
75 pounds sheet rubber.	28 rubber valves, 9-inch.
6 cylinder gaskets.	1 rotary pump.
20 gallons cylinder oil.	1 dwelling-house for engineer.
6 gallons lard oil.	And all the requisite tools.
16 gallons kerosene oil.	

**Respectfully submitted.**

**S. W. DUDLEY,**

*Superintendent.*







City of Cambridge

132014

THE

TWELFTH ANNUAL REPORT

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL,

TOGETHER WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTENDENT,  
AND OTHER DOCUMENTS,

FOR THE YEAR 1876.



BOSTON:

PRINTED BY MACDONALD & SONS,  
11 CHARDON STREET.

☆ CAMBRIDGE PUB LIBRY







Statement showing in brief the entire transactions on account of the Water-Works for the year ending Nov. 30, 1876.

#### Received.

Appropriation for Extension Account. . . . .	\$110,000 00
From Water-Rates . . . . .	179,166 76
From Supply Account and shutting off and letting on Water . . . . .	8,645 52
From Rent of House . . . . .	150 00
Interest on Sinking-Fund to June 30, 1876 . . . . .	7,570 45
Interest accrued on Bonds sold . . . . .	1,166 67
	<hr/>
	\$306,699 40

#### Expended.

Extension Account . . . . .	\$104,143 11
Care and Repair . . . . .	28,586 65
Supply Account . . . . .	7,071 52
Interest on Water Debt . . . . .	83,730 00
Unexpended Appropriation . . . . .	5,856 89
Balance showing Gain in 1876 . . . . .	77,311 23
	<hr/>
	\$306,699 40

#### Comparative Receipts.

Water-Rates for the year ending Nov. 30, 1876 . . . . .	\$179,166 76
Water-Rates for the year ending Nov. 30, 1875 . . . . .	138,880 37
	<hr/>
Showing Increase for the year 1876 . . . . .	\$40,286 39

Included in this increase is \$17,132.77, which we have received this year from the city for water which was furnished in previous years.

In reference to the foregoing statements of our doings the past year, we think it proper to state, that of the \$104,143.11 which was spent, and charged to "Extension Account," more than one-half was expended in accordance with the votes of

the City Council last winter, by which the Water Board, in consultation with the City Engineer, was authorized to expend \$26,000.00 to the best possible advantage in improving the several sources of our water-supply, *for the purpose of providing work for the destitute laboring-men*, at the uniform price of one dollar per day. As all this \$26,000.00 by the terms of the order must be paid directly to the men, we could take no part of it for any other purpose; and we were thereby compelled to pay for all pumping, pipes, tools, overseers, and all other incidental expenses, from our regular appropriation for Extension Account: this amounted to about \$28,000.00. The work was done under some disadvantages, on account of the haste with which it was decided upon, the season of the year, and the manner of doing the work. We spent the money as you directed, and as set forth in the order. We had so many applications for work, that we were obliged to restrict the men employed to those who would bring to us a certificate, from the Overseers of the Poor, that they were entitled to receive assistance from the city. Under this plan, we continued paying the men every day in one dollar bills; and we have on file the names of the men to whom this \$26,000.00 was thus paid. We think there can be no doubt that this money did a great amount of good among the poor people of Cambridge last winter.

At the time the city bought the Water-works there was a great difference of opinion among our citizens, whether it would ever pay. Some thought they would be a constant bill of expense to the city; while others thought differently. To be able to decide the question in the future, the then Mayor, now a member of this Board, interested himself to have the accounts of the Water-works kept separately; and, as the net profits of the works from year to year were passed to the sinking-fund of the Water-works, this was easily done.

We notice a change has been made by the City Council during the past year in the manner of making up the sinking-fund of the Water-works, by which a specified sum is passed to the fund annually, instead of the profits of the works, as heretofore. By so doing, the net cost of the Water-works will not hereafter appear by deducting the amount of the sinking-fund from the water-debt.

The following table will show the comparative rainfall, and the height of water in the pond, during the years 1875 and 1876:—

MONTHS.	Rainfall 1875, Inches.	Rainfall 1876, Inches.	Below high- water mark, 1875, Feet & Inches.	Below high- water mark, 1876, Feet & Inches.
December, 1875 . . . . .	1.50	1.04	5 feet 9	6 feet 1½
January, 1876 . . . . .	3.22	1.82	6 " 6	5 " 6
February " . . . . .	3.54	4.74	7 " 4½	5 " 5½
March " . . . . .	3.10	6.53	6 " 7½	5 " 1½
April " . . . . .	4.73	4.65	6 " 7	4 " 1½
May " . . . . .	3.08	3.07	6 " 5	3 " 8½
June " . . . . .	6.60	1.02	4 " 2½	4 " 0½
July " . . . . .	2.68	6.08	6 " 8½	4 " 11½
August " . . . . .	5.66	1.78	6 " 0½	5 " 4½
September " . . . . .	3.46	3.77	6 " 4½	5 " 5½
October " . . . . .	3.83	1.82	6 " 0	6 " 5½
November " . . . . .	4.86	6.76	5 " 9½	6 " 1½
Total rainfall . . . . .	51.46	43.60		

It will be seen by this table that the rainfall during 1876 was 7.86 inches less than in 1875.

	Gallons.
We pumped during the year 1875 . . . . .	992,247,000
We pumped during the year 1876 . . . . .	887,637,600
Showing decrease in 1876 . . . . .	104,609,400

This difference in pumping can be accounted for by the extraordinary demands made on us on account of the severe cold weather of the winter 1874 and 1875, which made the pumping of 1875 very much more than it would otherwise have been.

The new sources of our water-supply which are reached by our new conduit have already been of use to us in keeping up our supply: at least three-fourths of our water-shed is reached by this means; and our facilities for catching and storing the water *when it comes* will largely determine the extent of our water-supply.

A comparison of the months of October and November of 1876 will present this subject in a forcible manner.

	IN.	GALLS.
Amount of Rainfall in October . . .	1.82	
Amount of Water pumped same time . . .		58,606,200
The Pond was lowered during the same time 6½ or		32,500,000
Showing the Amount of Supply in October, from the new conduit and other sources unseen, to have been . . . . .		<u>26,106,200</u>
Amount of Rainfall in November . . . . .	6.78	
Amount of Water pumped same time . . . . .		56,234,100
Gain in the Pond during the same time 15½ or		<u>78,750,000</u>
Showing the Amount of Supply in November, from the new conduit and other sources unseen, to have been . . . . .		<u>134,984,100</u>

With the new conduit now completed and in good working condition, we hope and expect, if we have the usual amount of snow and rain during the coming winter and spring, to be able to fill up Fresh Pond to high-water mark. With the pond thus filled, we should have in store in Fresh Pond, above the top of the conduit that leads to our pumps, 500,000,000 gallons. If to this we add the storage capacity of Spy and Little Ponds, now at the same level, we have about 385,000,000 gallons more; together making about the same as last year's consumption.

#### Work Done.

*First,* The work of cleaning out that part of Fresh Pond near the Engine House, comprising about eighteen acres, which was in progress at the time we made our last Report, was prosecuted with vigor until its completion. It was not finished in time to do any thing about the banks; and they were left until spring, that they might settle, and be in good condition to pave. As soon as the frost was out of the ground last spring, the work of grading and paving the banks was done under the direction of the City Engineer. The work was finished to our satisfaction, and presents a neat, substantial appearance.

*Second,* A considerable work has been done towards cleaning out what is known as "Black's Nook," where our new conduit



enters Fresh Pond: a large amount of muck and vegetable deposit was removed from this place. The banks around have been shaped up, and, to some extent, gravel dressing has been put around the borders; so that it presents now to the passer-by a comparatively clean and tidy place, instead of the very objectionable slough-hole it was before.

*Third,* A new thirty-inch conduit has been laid between Little and Spy Ponds, with suitable gate-house and other connections, thus giving us the control of all the water-supply to which we are entitled under our charter. This is so arranged, that we can fill up Spy Pond from Wellington Brook and Little Pond, or draw from it to re-enforce Fresh Pond, as our condition may require.

*Fourth,* Under the direction of Mr. Chase, our former City Engineer, a large amount of work was done to clean out and improve Little Pond. A strip of land five rods wide, around portions of the pond where it was needed, was taken, and cleared of the trees and brush thereon. Arrangements were then made, and the water in the pond pumped out, so as to expose the bottom in the shallow parts of the pond. The part exposed was soon frozen, so that it could be worked upon. A large force of men was then put at work, cutting and wheeling out the boggy material in the bottom, which was deposited on the surrounding shore. This plan was followed until two or three layers, in some places, had been taken out. The plan of working was a complete success; and a very large amount of objectionable material was removed from the pond.

Our experience proved that sufficient means had not been provided to keep the material on the shore after we got it there. A large part of what was taken out was frozen when it was piled on the shore. Soon after, and before the frost came out, and the banks had time to settle, a flood came, and raised the water high in the pond against the banks that had been formed. This took the frost out of the lumps of muck; and a considerable portion of the bank melted like snow, and ran back into the pond again: still a part of what we took out remained on the shore, and some improvement has been made in the pond.

We think our experience shows that there is no way to retain the banks in the soft lands which border some parts

the pond, except by driving a row of sheet-piling to hold the pressure, and keep the water from washing the banks down.

It may be remembered that last year, as compared with the year before, showed a falling-off, in our receipts, of \$14,753.90. We gave what then seemed to be satisfactory reasons for this decrease. During the past season, we have discovered that there was still another reason beside those named, which was found in the unfaithfulness and dishonesty of A. F. Fifield, our late Registrar.

The Auditing Committee of 1875, Messrs Carter and Slocumb, had not completed their work when the city documents went to the printer, and therefore there was no report from that Committee of this Board made last year. The Committee could not make the accounts of the Registrar agree, and they became suspicious that they were not right. The explanations of the Registrar were not satisfactory; and they determined to push their investigations until they were satisfied. They pursued their work faithfully, devoting several weeks of personal attention to the examination of the books and accounts. This involved going several times over more than six thousand different accounts. As a result, they became satisfied of the Registrar's incompetency, and found good grounds to distrust his honesty.

At this stage, the matter was reported to the Board; and it was evident that only by a long and thorough examination of our books by an expert could we ascertain the true state of affairs in this department. It was determined to make the work thorough; and for this purpose a special committee of three, composed of Messrs. Merrill, Bradford, and Allen, was appointed, with full powers.

The Committee employed Mr. J. A. Holmes as an expert, with such other assistance as was needed to help him. It was not long before this Committee became satisfied that the Registrar was both incompetent and dishonest. Up to this time, the Registrar had stoutly maintained, that, while there might be errors in his accounts that could be rectified, every thing was honest on his part. The Committee, acting on the evidence they had, recommended the Board to discharge him; which was done at once. The next morning he fled from justice, thus fully confirming the views of both Committees in regard to him. It is a sad duty thus to report the fall of one who was a general

favorite, and who had many qualities that peculiarly fitted him for the office he held.

The Committee prosecuted their labors through several months, making a careful examination of our books and accounts for several years past; and the result leaves no doubt that our late Registrar is a defaulter to a large amount, which he has taken from time to time, extending over several years. We shall submit to the City Council copies of the Report of the Special Committee, with the results of their examination, which will furnish you with all that we know about this matter up to that time. The investigation is still going on; and, when completed, a full report will be made.

The city holds the bond of the late Registrar in the sum of five thousand dollars, with the Registrar's father and Mr. Israel Tibbetts as sureties.

#### General Remarks.

Almost every year, for the past few years, there have been stories circulating through the community, calling in question the purity of our water, and its fitness for domestic use.

We need hardly say that a matter so intimately connected with the comfort and health of our citizens has not failed to receive from us careful attention. The principal reasons for any dissatisfaction that may exist we think may be found, *First*, In the use of Fresh Pond for boating, by which more or less persons have been drowned, and in some cases the bodies have been in the pond several days before they were recovered; *Second*, The surface-drainage that finds its way into Fresh Pond from the dwellings and lands around the pond, and which is constantly increasing as the surrounding country becomes settled; *Third*, The character of the land and surroundings of the country, the water-shed of which supplies Wellington Brook, and Little and Spy Ponds, our new sources of water-supply.

We are glad to know that application has been made to the legislature for authority for the city of Cambridge to remedy the *first* reason above named; and we cannot doubt, that, if the matter is properly presented, the right will be granted to forbid any boating in the future.

In regard to the *second* ground of complaint, we can only say



that there are undoubtedly some places where the drainage from various sources finds its way indirectly into Fresh Pond, more particularly in times of heavy rains, and during the spring freshets caused by the melting snow. We have called the attention of the City Council to this in several of our Annual Reports; but, as the City Council changes from year to year, we think what we have said in regard to this matter has been lost sight of, and the whole subject is brought up, and treated as if it was a new thing, which has been overlooked or neglected by us. It has been the policy of the Board to do those things first which seemed the most important, expecting to do all that was necessary as the works progressed, and the required appropriations were made. A careful analysis of the water from time to time has failed to show any change in the quality of the water in Fresh Pond, and no practical evil has thus far resulted from what drainage has found its way into the water we use.

We are satisfied, that while the evil of surface-drainage can be wholly removed only by a sewer around the pond, yet, at a small expense, a large part of the drainage into the pond can be so arranged as to be filtered through a gravel-bank before it finds its way into the pond, thus removing all substances held in suspense, and greatly mitigating, if not wholly removing, the evil.

In regard to the *third* (ground of fear we shall call it), we had a careful analysis made of all the waters reached by our new conduit, in June, 1875; and the result showed that the average quality of Spy and Little Ponds, and Wellington Brook, was better than Fresh Pond at the same date; and thereupon we proceeded to secure these waters as soon as we could. All analyses made since have confirmed the purity of these waters.

We now present to you extracts from our former Annual Reports, to which we have already referred, showing what we recommended to be done to improve and protect the

#### Purity of the Water.

1872. "In closing our Report, we wish to refer to a matter that does not come under our especial charge, a plan by which we think the condition of the pond might be greatly improved: we mean the construction of a road around the border of our beautiful lake.

"There is a constantly-increasing demand upon us to provide for the drainage from the estates bordering on the pond, which now pollutes the water. The construction of a sewer in connection with such a road would carry all the drainage into Alewife Brook, below the outlet of the pond. This, with the cleaning-up of the banks between such a road and the borders of the pond, would do much towards keeping the water clean and pure.

"The parties who own the land abutting on the pond are largely engaged in cutting and storing ice; and it is for their interest to increase the purity of the water and the area of the pond by clearing out the vegetable matter therein. We have reason to believe they would join in this great improvement. The greatly enhanced value of the four or five hundred acres of land that would thus be rendered a most attractive locality for building-purposes would make it an object alike for the city and the town of Belmont, and the land-owners, to spend the money required for this purpose, aside from the benefit it would be to our natural reservoir."

1873. "We were gratified at the prompt action of the City Council in voting to put in a sewer in Concord Avenue and Vassal Lane, by which a large amount of surface-drainage on the easterly side of the pond can be kept out of the pond, and carried below the outlet into Alewife Brook, while at the same time we can properly drain the new pumping works that have been erected. The subject of protecting our water-supply from drainage around the pond is an all-important one, and appeals to the personal interest of every one who uses the water.

"The sewer already voted in will undoubtedly, in the end, be part of a continuous one reaching entirely around the pond. As the borders of the pond become more thickly settled, the necessity of this course will present itself more and more."

1874. Among the things enumerated in its Annual Report, which the Board thought necessary to do, we find recommended, "The ultimate extension of the sewer, already commenced, entirely around the pond, so as to cut off all filthy drainage into the pond. This kind of drainage is constantly

increasing, as the region around becomes more settled, and will soon demand serious attention."

1875. "To clean out that part of the pond known as 'Black's Nook,' where our new conduit enters the pond. Undoubtedly other things will be found necessary to improve the purity of our water, and increase our resources."

It will thus be seen that the subject of the "Purity of our Water" has not escaped our attention. We have not had any evidence presented to us to show that the drainage into the pond has had any appreciable effect upon our water, thus far. Our pond at high water contains from 1,200,000,000 to 1,500,000,000 gallons of water, an amount nearly equal to two years' supply. It will be seen that whatever comes into the pond in the form of drainage becomes diluted in this vast body of water, in addition to half as much more which finds its way into the pond from various sources every year. In order that you may see the past and present condition of our water in respect to purity, and that we have not been remiss in applying the best chemical tests to prove its quality, from time to time, we give you herewith a table showing analysis of all the waters that come into our water-supply. You will notice that we have no analysis reported from 1853 to 1872, a term of nineteen years, in which time, so far as we know, the question of the purity of the water was not raised.

In connection, we give you a table of the analysis of the water from eight different wells in our city, and some from other towns around, also of the Cochituate and Mystic waters. By comparison, you will see, that, while our water is not as pure as some other water-supplies, it is *very greatly* superior to any of the well-waters; and it will also be noted that most of the analysis of Cambridge wells was made many years ago, before the soil was so much impregnated with drainage as now.

## ANALYSIS OF CAMBRIDGE WATERS.

WATER FROM.	CHEMIST.	DATE.	RESULTS IN 100,000 PARTS.					
			Inorganic Matter.	Organic Matter.	Total.	Free Ammonia.	Albuminoid Ammonia.	Total.
Fresh Pond . . . .	Mariner . .	July, 1853.	8 51	2 31	10 82			
" . . . .	Sharples . .	Oct., 1872.	16 49	5 00	21 49			
" . . . .	Horsford . .	1873	9 72	4 68	13 77			
" . . . .	Sharples . .	Feb. 22, 1875.	8 00	5 00	13 00	.0170	0185	0325
" . . . .	" . .	Mar. 12, 1875	9 00	4 00	13 00			
" . . . .	" . .	June 2, 1875.	11 00	3 00	14 00	0060	0060	0110
" . . . .	" . .	June 16, 1875.	9 50	3 00	12 50	0050	0060	0110
" . . . .	" . .	Mar. 9, 1876.	10 00	4 20	14 20	0048	0060	0128
Average of eight analyses . . . . .			10 25	3 82	14 07	0079	0080	0168
Spy Pond . . . .	Horsford . .	— 1870.	9 60	6 40	16 00			
" . . . .	Sharples . .	Feb. 22, 1875	12 00	5 00	17 00	0124	0217	0341
" . . . .	" . .	June 2, 1875.	11.70	3 00	14.70			
Little Pond . . . .	" . .	June 2, 1875.	8 70	4 50	13 20	0016	0110	0126
" . . . .	" . .	Mar. 13, 1876.	13 40	6 60	20 00	0125	0120	0245
Spring . . . .	" . .	" . .	13 20	6 80	20 00	0088	0080	0168
Pump . . . .	" . .	" . .	18 60	4 50	22 50	0064	0064	0128
Wellington Brook.	" . .	June 16, 1875.	7 50	3 00	10 50	0020	0090	0110
Alewife Brook. . .	" . .	June 16, 1875.	9 50	4 50	14.00	0050	0120	0170

## ANALYSIS OF VARIOUS WATERS.

LOCATION.	CHEMIST.	DATE.	RESULTS IN 100,000 PARTS.					
			Inorganic Matter.	Organic Matter.	Total.	Free Ammonia.	Albuminoid Ammonia.	Total.
Richardson's Well, Dana Hill,	Mariner.	Dec. 1853.	19 90	6 60	26 50			
Sawyer's Well Main & Pleasant,	"	"	23 70	7 50	31 20			
Warren's Well Dana Hill.	"	"	23 10	5 20	28 20			
Pump Water Main & Norfolk,	"	"	46 50	19 30	65 80			
Richardson's Well, Dana Hill,	"	"	42 90	15 00	58 50			
Fresh Pond Meadows,	Horsford.	Dec. 1870.	22 40	9 60	32 00			
Well Cottage Street, North Cambridge,	Sharples.		16 42	8 75	25 17			
Well, Craigie St., Cambridge,	"	1873.	20 54	35 24	55 82			
Well in Cambridge.	"	"	7 85	17 83	25 68			
Well, Crosby St., Arlington,	"	1875.	22 00	14 50	36 50			
Well in Charlestown,	"	"	14 00	60 00	74 00	0248	0279	0327
Well in Chelsea,	"	"	15 00	24 00	39 00			
Well in Brookline,	"	1876.	13 88	47 06	60 94	2309	1008	3327
Well in Jamaica Plain,	"	1873.	41 51	38 49	79 99			
Cochituate,	Jackson.	1854	2 59	1 84	4 43			
"	Nichols.	1870	3 08	1 12	4 20			
"	Hayes	1871.	4 00	1 42	5 42			
"	Sharples.	1874.	2 01	2 78	4 79			
"	"	1873	2 10	2 40	4 50			
"	"	1875.	4 00	1 50	5 50			



We also give you, by some references to our past Reports, the evidence that we have also given attention to our prospective wants in an

**Additional Water-Supply.**

There was a general belief, in the early history of our water-works, that Fresh Pond would furnish an unlimited supply of water. The great droughts of 1872 and 1873 dispelled this illusion, when, for a considerable time, the amount we pumped out of the pond daily lowered the pond by just about the same amount of water as measured by its area.

Another prevailing opinion was shown to be without any foundation; to wit, that there was an underground connection between Fresh Pond and Little and Spy Ponds, as the constant lowering of Fresh Pond had no appreciable effect on the other ponds. With these facts before it, the Board foresaw, that, at some not very distant day, our rapidly-growing city would need a larger water-supply; and we find in the Report for 1872 a recommendation "that application be made to the legislature, that we be permitted to take the water from such streams in this county (the right to which is not already granted others) as we can bring to advantage to re-enforce our present water-supply."

No notice having been taken of this recommendation, so far as we could learn, the same recommendation was repeated in the Water-Board Report of 1873. A hearing was secured for us before the proper committee of the legislature; but Watertown and Belmont opposed our taking Clematis Brook to re-enforce our supply, when, in 1874, the Board recommended that "application be made to the legislature for the right to take water from such streams as can conveniently be brought to re-enforce our present water-supply, when by so doing we shall not interfere with any rights already granted to others."

We recommend the following things which need to be done, and we present them in the order of their importance as presented to our minds, and for them in due time we shall ask from you the necessary appropriations, in addition to the amount for extending the street pipes.

*First*, Secure a strip of land around Fresh Pond of sufficient width to enable us to preserve the purity of the water in the

pond ; and we think that the land needed for this purpose can be properly ascertained only by a careful topographical survey of the land around the pond.

*Second*, Provide a basin which will receive nearly all the surface-drainage now coming into the pond, and from which the drainage-water can find its way into the pond, only after being filtered through a bed of gravel. This we think can be done at a very moderate cost, after securing the necessary land.

*Third*, Drive sheet piling around the low borders of Little Pond to hold the bank, and enable us to prevent the drainage from the surrounding low lands from running into the pond.

As our city is growing rapidly, and every year is calling for more water, we think it is wise for us to do what we can to anticipate our future wants ; and we recommend that suitable action in proper season be taken next fall to petition the legislature for the right to take such water as we can get conveniently to re-enforce our water-supply.

Since writing the foregoing, we have had made by request of the joint Committee of the City Council appointed to confer with the Water Board in regard to the purity of our water, and other matters pertaining to the water-works, an analysis of all the different waters connected with our water-supply ; and we herewith send to you a copy of the report made of the analysis of the waters by S. P. Sharples, Esq., chemist, and State assayer. Much valuable information is given therein in regard to our water-supply and other matters of interest in connection therewith ; and we think this document should be published with our Report, for the information of the people, and for future reference.

We make therefrom the following brief extracts, to which we would call especial attention : —

“ It will be seen from the analysis, that, while the water supplied to Cambridge is much harder than most of the waters quoted, in point of purity, and freedom from sewage-matter, it compares favorably with the best of them ; being fully equal, in this respect, to Cochituate when delivered from our hydrants.

“ I would therefore recommend that the supply from Wellington Brook and the filter-basin at Little Pond be utilized at once.”

It gives us pleasure to testify to the valuable services of W. S. Barbour, our City Engineer, who has taken a great interest in all our work, and rendered to us cheerful and valuable assistance.

For any further details that may be required in regard to the condition of our Works, we would refer to the Reports of the Registrar and Superintendent made to this Board, which we herewith submit as part of our Report.

GEO. P. CARTER,  
J. WARREN MERRILL,  
H. L. EUSTIS,  
C. W. KINGSLEY,  
F. A. ALLEN.



# REPORT

ON

## POLLUTION OF WATER-SUPPLY.

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THE Joint Special Committee of the City Council appointed to confer with the Water Board as to the sources of pollution to our water-supply, and the means of preventing the same, have attended to their duty, and respectfully report.

A meeting was arranged with the Water Board, when the object of the Committee was presented, and such information as the Board could furnish was requested.

A detailed statement of what the Board had done to ascertain the purity of the water from time to time, since the city bought the works, was presented, with tables showing the analysis of the water at the time it was taken for the use of the city, and at various times since, down to a recent date. All these analyses show that the water of Fresh Pond has nearly maintained its original standard, as per Mr. Sharples's Table No. II., attached to this Report. This table also shows that our new sources of supply — viz., Little and Spy Ponds, and Wellington Brook — are, taken together, as pure as Fresh Pond. In answer to our inquiries, the Water Board informed us that there were some places where, at certain times of the year, drainage might find its way into the pond, and referred us to their Reports of previous years to the City Council, wherein they claimed they had fully presented the matter, and suggested the remedy.

Being anxious to obtain all possible information, your Committee made a personal inspection of the borders of Fresh Pond, also of the connection made with Little and Spy Ponds and Wellington Brook, and their surroundings, which was as thorough as the season would admit. The only places from which

your Committee think that there is immediate danger to Fresh Pond are on the south-westerly side, near Cushing Street, where more or less drainage, at certain seasons of the year, finds its way into the pond, and should be cared for at once; also from the drainage which may find its way into the pond from Fresh Pond Hotel, and the picnic-grounds and the boating connected therewith. The Mayor has already taken the proper steps to bring a petition before the legislature for authority to prevent boating on the pond, which, if successful, will remove one great cause of complaint. In regard to the picnic and hotel grounds, your Committee would recommend, that so much of the land bordering on the pond as is connected with these premises be immediately taken under the authority given us by the legislature, and that the same be properly fenced, so as effectually to exclude all persons from the pond in that locality. Our inspection of Little Pond satisfies us that the chance of any deleterious matter finding its way into the pond is very small. In regard to Wellington Brook, there are some houses in Belmont, whose drainage, if any, would naturally find its way into the brook. In one place there are also a number of pig-pens, from which, in heavy rains or melting snows, surface-drainage finds its way into the brook. The analysis shows that the amount of pollution which finds its way into the brook from this source is more imaginary than real: still we think that arrangements should be made with the owners, either to remove the pens entirely, or, if that cannot be done, to change their location, so that all the wash or surface-drainage would run southerly, and away from the brook; and that a tight cement cistern be built to catch and hold the drainage.

We did not make an inspection of the borders of Spy Pond, as we were informed by the Water Board that they were not taking water from the pond, and did not intend to do so (except in an emergency), until they had made a careful examination and analysis of the water at different seasons of the year, as recommended by Mr. Sharples. After making this personal inspection, we arranged for another meeting, to which we invited the gentlemen who had appeared before the Board of Aldermen when this matter was before that Board, together with the Water Board, to meet us, and give their views in regard

to what should be done. Our attention was called to the drainage which finds its way into our water-supply, as herein referred to; and also to the character of the land which forms the water-shed, from which a large part of the water comes to make up Wellington Brook and Spy and Little Ponds. No plan was presented or recommended to remedy the evils complained of; but it was thought by some of the gentlemen, that a commission should be employed, consisting of an engineer, a chemist, and a sanitarian, to examine the whole subject of the quality and quantity of our water-supply.

The extent of our supply, and the quality of our water, were discussed by the members of the Water Board; and, so far as possible, the subject was considered in all its bearings. This has satisfied your Committee that an expenditure of money in this direction is not called for at present. If we were seeking a new supply, the quality and quantity of which were unknown, then a commission, as suggested, would be desirable; but from the fact that the Water Board is aware of the sources of pollution that exist, and that it now has, and has had for years, the services of as competent an engineer and chemist as would probably be on a commission, we think, that, if the appropriations asked for are made by the City Council, our water-supply will be protected just as well as through the recommendations of a paid commission.

To satisfy ourselves in regard to the present condition of the waters, we decided to have a thorough analysis made of all the water we command; and herewith we submit the Report of S. P. Sharples, Esq., chemist, which presents the matter of the quality of the water in a most favorable light, both on its own merits, and in comparison with other water-supplies. To this Report, with the tables annexed, we invite your careful attention. This Report seems conclusive evidence to your Committee, that most of the danger apprehended, that our water will be contaminated by the drainage from cultivated lands (which largely compose the water-shed), has no foundation in fact. We think Mr. Sharples's statement in his Report — "that Nature understands her business, and, if we only give her time enough, will take care of all noxious organic matters in water" — is a fact acknowledged by all chemists, and should be taken as such, until science disproves the same.



Perhaps it is a misfortune that our water-supply is too near home, and is subject to the personal observation of our citizens from day to day. This is probably the reason we hear complaints. Persons see and report what in itself is impure, not thinking of the process of purification that takes place before the water they see is used.

It is the opinion of this Committee, after a careful comparison of our own supply with others with which we are acquainted, that Fresh and Little Ponds, and Wellington Brook, are as favorably situated, as regards their liability to contamination, as any other supply that can be named, as we have no large manufactories pouring their drainage and refuse matter into our water, nor are they surrounded by large barn-yards, and other out-buildings usually to be found surrounding ponds and streams farther away from the city. In this connection, it is proper to state, that while several physicians of Cambridge appeared before our Committee, yet no complaint was made to us in regard to the water being unwholesome, or in any way injurious to the public health; and this point is fully covered, we think, by Mr. Sharples in his Report. On page 13 he says, "It will be seen from these analyses, that, while the water supplied to Cambridge is much harder than most of the waters quoted, in point of purity, and freedom from sewage-matter, it compares favorably with the best of them; being fully equal, in this respect, to Cochituate when delivered from our hydrants."

Fresh Pond is really our reservoir or settling-basin, and should be protected from the constantly increasing drainage on the shores. While no perceptible evil has yet come from this source, yet it is wisdom to provide for the future, and see that the pond is properly protected. To do this, we must control the borders of the pond, and, if possible, the pond itself. And we would therefore recommend that *immediate* action be taken, under the authority that we already possess, to control that portion of the borders connected with the hotel and picnic-grounds, and on the south-westerly side, near Cushing Street, as previously mentioned in this Report; and that after a careful survey has been made, and a system of sewerage adopted for this whole territory, then whatever land is shown by the survey to be necessary for the full protection of the pond, and for ulti-

mately building a sewer entirely around it, be taken for that purpose. It seems to us that any action in taking or purchasing land until this is done would be in the dark.

In conclusion, your Committee feel that this whole subject of our water-supply and its protection is in competent hands, and can be safely left there, provided the City Council make the appropriations necessary to carry out their recommendations. The Water Board is composed of gentlemen who have for years made this subject their study, and seem to understand the whole subject. They are personally interested, in their official capacity, that every thing should be done to keep their department up to a high standard, and, as citizens and tax-payers, that all appropriations asked for should be economically and judiciously expended.

All which is respectfully submitted.

SAM'L L. MONTAGUE,  
GEO. H. HOWARD,  
PEREZ G. PORTER,  
GEO. F. WHITING,  
ARCHIBALD M. HOWE.

# REPORT

## ON THE

### WATER-SUPPLY OF CAMBRIDGE.

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CAMBRIDGE, Dec. 18, 1876.

TO THE JOINT SPECIAL COMMITTEE OF THE CITY COUNCIL OF THE  
CITY OF CAMBRIDGE.

*Gentlemen,* — Having at your request visited the designated localities, I herewith transmit a report on the quality of the water analyzed.

Samples of water have been collected from the following localities: —

No. 1. From the surface of Fresh Pond, directly under the ice, which was about an inch thick. This sample was slightly milky, evidently from suspended clay. It will be recollected that the pond was not frozen over until Sunday, and that Saturday we had a violent gale from the north-west: this had the effect of stirring up the water somewhat, and it had not yet entirely settled. The sample came from just outside the gate-house, at the inlet to the pump-house.

No. 2. From the service-pipe at my house on Shepard Street.

No. 3. From Spy Pond, about twenty feet from the gate-house, at the surface. This showed considerable amounts of infusoria.

No. 4. From Little Pond, about twenty feet from the gate-house, at the surface.

No. 5. From the filter-basin, close to the wall next to Little Pond. The water was flowing in here in a strong stream, which

the men who were working in it said was quite warm as compared with the water of the pond.\*

No. 6. Wellington Brook, near the gate-house, just under the ice.

No. 7. Wellington Brook, about fifty feet above the stream coming from the direction of the pig-pen of Mr. Richardson.

No. 8. The shallow well in Mr. Crosby's field, Pond Street, Arlington. This is not, strictly speaking, a well, but is a box through which the water from the drain which underlies a portion of the field passes. It is the same place that has been spoken of at the hearings.

No. 9. The well in Mr. Crosby's kitchen, Pond Street, Arlington. It having been stated at the hearings that this well was a bad one, it was deemed desirable to obtain a sample of the water for comparison with the other waters.

No. 10. Cochituate water, as drawn from the faucet in my laboratory, 114 State Street, Boston.

These samples, with the exception of 2 and 10, were procured on the morning of Dec. 13, and immediately taken to my laboratory. No. 10 was drawn on the 15th inst., and No. 2 on the 16th.

The method of analysis followed was that laid down by Profs. Wanklyn and Chapman for the determination of ammonia. The solid residue was determined in the usual manner by evaporation to dryness. The results of these ten analyses will be found in Table No. I. In the case of samples Nos. 4 and 5, it was deemed advisable to make full analysis as showing more nearly the relation between the two samples of water. These analyses, taken in connection with the two former, show conclusively, I think, that the water in the filter-basin does not come from Little Pond, but from the springs which abound in this locality. In digging out the easterly end of Little Pond, a similar set of springs was found. These were analyzed at that time, with the results shown in Table No. II.

In Table No. II. I have collected all the analyses of the waters in the vicinity of Fresh and Spy Ponds to which I have access.

\* The temperature of the water in the pond, as taken by Mr. Dudley on the 15th, was 39° F.; of the water in the filter-basin, 46° F.; and of the air over the basin, at noon, 35°.



I have also added a number of analyses of Mystic and Cochituate Ponds, and Merrimack and Charles Rivers, together with a single analysis of Schuylkill River water.

The analyses of Charles River and Merrimack water are quoted as being the best-known instances of the use of filtering-galleries. It is noticeable, however, in both these cases, that a considerable portion of the water is evidently not derived from the rivers, but from the springs uncovered in digging the galleries. They thus afford exactly parallel cases to the filtering-basin at Little Pond.

The ground-water of Fresh, Spy, and Little Pond basins, is so totally different from that of Lake Cochituate, and the surface-water which is carried off by the two rivers, that it is difficult to make any comparison between them.

The basin in which these ponds lie has evidently been at one time beneath the ocean, as all the ground is saturated with lime and magnesia salts: these, entering into the spring waters, serve to make them hard. In fact, all the ground-water, as distinguished from the mere surface-flow, is in this vicinity extremely hard, as is shown by numerous analyses of wells that have been made in the vicinity of Boston, of which the Crosby Well is a fair example.

The waters of Spy, Little, and Fresh Ponds, are evidently, to a considerable extent, derived from these ground-waters, as is shown by the amount of solid matter which they leave on evaporation. Wellington Brook partakes, to a smaller extent, of the same characteristic, being derived from springs in part. Lake Cochituate and Charles and Merrimack Rivers, lying outside of this basin, have an entirely different character: they are all largely derived from surface-drainage, and consequently are much softer water, and much more free from earthy matter. They are also much more variable waters than Fresh Pond. Fresh Pond, being supplied to a considerable extent from underground sources, remains very constant in composition.

Since comparison by amount of solid residue is out of the question, we must fall back upon another method.

We cannot compare them by the amount of organic and volatile matter, because while this, in the case of the rivers and Lake Cochituate, very nearly represents the amount of organic matter

present, in the case of the ponds, it also includes a considerable amount of water which is in combination with the lime and magnesia salts, and which is not expelled at 212° F. The amounts of lime and magnesia salts in these waters are much less than in Thames water, and are not present in sufficient quantity to do any harm beyond rendering the water slightly hard. The ammonia determinations fortunately give us a method of comparison. The amount of ammonia in the water gives us with a great deal of accuracy a means of judging of the purity of water, and its freedom from sewage, or contamination from animal sources. The changes which take place in animal matter when in a state of decay may be briefly described as follows. The first change which takes place is their splitting up into carbonic acid, and compounds similar to ammonia. If oxygen is plenty in the water, these compounds are soon converted into nitrates, which are, in turn, decomposed, nitrogen being set free.

In the case of the shallow well in Crosby's Field, on which, it is said, six cords of night-soil, and six cords of stable manure, have been spread annually for the last twenty years, we have this process well illustrated. The ammonia has all been oxidized to nitric acid; and we have a considerable amount of nitrates present, but almost no ammonia, either free, or capable of being set free. Now, it will be noticed, in the tables we have two columns, headed Free Ammonia and Albuminoid Ammonia. The free ammonia is perfectly harmless, having been once in the form of animal or vegetable matter: this has been decomposed, and it is set free. The albuminoid, however, represents the animal or vegetable matter that is in the water, and is capable of yielding ammonia: this indicates, to a great extent, the purity of the water, or, rather, its fitness for domestic use; if it increases very much, the water is to be looked upon with suspicion.

It is generally considered that one part of albuminoid ammonia is equal to ten parts of solid sewage-matter. Thus, taking the maximum amount as found in Fresh Pond Feb. 22, 1875, 100,000 pounds, or 12,004 gallons, would contain .155 pounds of solid sewage-matter; Wellington Brook, June 16, 1875, would contain in the same amount .090 pounds, which is a little in excess of the amount contained at the previous determination, which was .064 pounds; while Cochituate, Dec. 15, contained .100

pounds : so that Wellington Brook compares very favorably with Cochituate, and is better than Fresh Pond water as taken from the surface, which contains .160 pounds in the same amount. One thing is worthy of remark in this connection ; and that is, the purification of the water as it passes through the pipes. The water as delivered in a city is almost always more pure than when taken from the gate-house, or inlet. This is well shown in all the examples quoted. Thus the albuminoid ammonia in Fresh Pond water, as taken from the pond Dec. 13, was .0169 parts in 100,000 : as taken at the house on the 16th, it was .0060 parts. It must be remarked, however, in this connection, that the water taken immediately under the ice is generally below the average in purity. Cochituate from pond, June 16, 1875, contained .0032 parts ; from my office, June 18, it contained .0070 parts ; Merrimack, at Lowell filter-basin, .0037 parts : service-pipe in Lowell, .0013 parts ; filter-basin at Waltham, .0103 ; house-service, .0033. The above quotation of Cochituate does not follow the rule : it is, however, an exceptional case. Numerous determinations made by Prof. Nichols show that the water as delivered in Boston is better than when it left the lake.

In fact, Nature understands her business, and, if we only give her time enough, will take care of all noxious organic matters in water. It is only when such matters are taken fresh into the system that danger is to be apprehended.

Now, since the conduit enters into Fresh Pond comparatively near the surface, and at a distance of over half a mile from the inlet pipe to the water-works (which is at least twelve feet below high-water mark), and discharges into a body of water sufficient for nearly two years' supply for the whole city, it would be probably many months from the time its water entered the pond before it was taken out. And moreover, since these waters of Little Pond, Spy Pond, and Wellington Brook, so closely resemble Fresh Pond in all particulars, I can see no possible damage that may arise from their use.

In respect to Spy Pond, however, I think further investigation would be advisable. There is found in this pond a small green microscopic plant, which is very much more abundant during some seasons of the year. This plant seems to be closely allied to the red snow of the arctic regions, being a simple cell.



It is very readily removed from the water by filtration; and when in the growing state, in winter, it seems to impart no bad taste or odor to the water; but in the spring, as the weather gets hot, it dies, and then the water for some time is said to be very offensive.

I would therefore recommend that the supply from Wellington Brook and the filter-basin at Little Pond be utilized at once; I see no necessity for carrying Wellington Brook into Little Pond as proposed; it will not be improved by the operation; and that Spy Pond be closely watched for a year or two, with frequent analyses, and that, if needed, the water be drawn off when at its best, and filtered before it is admitted into Fresh Pond.

Of the analyses given, those marked H. are by Prof. Horsford; those marked M., by Mr. Mariner, who was at that time a student of Prof. Horsford's; W. are by Prof. Edward S. Wood; N. are by Prof. William R. Nichols, who has devoted much time and attention to this subject, under the direction of the State Board of Health, and whose papers in its annual reports will be found extremely valuable reading; the one marked C. is by Dr. Cresson of Philadelphia; while those marked S. are by myself, and have been made for the benefit of the Water Board of Cambridge.

It will be seen from these analyses, that, while the water supplied to Cambridge is much harder than most of the waters quoted, in point of purity, and freedom from sewage-matter, it compares favorably with the best of them; being fully equal in this respect to Cochituate, when delivered from our hydrants.

To show the rapid manner in which sewage is eliminated from water, I give some quotations from eminent English authorities.

Dr. Frankland says, in 1867, in the "Quarterly Journal of Science," "The population in the basin of the Thames above where water is taken is 1,000,000, the drainage of some 600,000 of whom is poured into the river. This sewage is so thoroughly oxidized, that no trace of it can be detected in an unoxidized state. The average flow where the companies take their supply is 800,000,000 gallons daily: the sewage contained would be  $\frac{2250}{1000000}$ ."

Dr. Letheby states, "I have arrived at a very decided con-

clusion, that sewage, when it is mixed with twenty times its volume of running water, and has flowed a distance of ten or twelve miles, is absolutely destroyed ; the agents of destruction being infusorial animals, aquatic plants and fish, and chemical oxidation."

The Royal Commission on the water-supply of London says in 1869, " But though, for these reasons, we believe that the organic contamination of the Thames is much less than is commonly imagined, still it would be sufficient to do great mischief, were it not for a most beneficial provision of Nature for effecting spontaneously the purification of the streams. Some of the noxious matter is removed by fish and other animal life ; and a further quantity is absorbed by the growth of aquatic vegetation : but, in addition to these abstractions, important changes are effected by chemical action. The organic compounds dissolved in water appear to be of very unstable constitution, and to be very easily decomposed ; the great agent in this decomposition being oxygen, and the process being considerably hastened by the motion of the water. Now, as such waters always contain much air dissolved in them, the decomposing agent is ready at hand to exert its influence the moment the matter is received into the water, in addition to which the motion causes a further action by the exposure to the atmosphere ; and when (as in the Thames) the water falls frequently over weirs, passes through locks, &c., causing further agitation and aeration, the process must go on more speedily and effectually. The effect of the action of oxygen on these organic matters, when complete, is to break them up, to destroy all their peculiar organic constitution, and to re-arrange their elements into permanent inorganic forms, innocuous, and free from any deleterious quality. This purification process is not a mere theoretical speculation. We have abundant practical evidence of its real action in the Thames and other rivers."

In order to show the quality of Thames water as referred to above, I annex Table No. III., which gives the results of the analysis as made for the month of October, 1876, by Mr. Tidy, for the society of Medical Officers of Health. As will be seen, these waters differ from Fresh Pond water mainly in the amount of lime they contain.

TABLE I.  
PARTS IN 100,000 PARTS OF THE WATER.

ANALYSES BY S. P. SHARPLES. WATER TAKEN DECEMBER 13 TO 16, 1876.

LOCATION.	AMMONIA.			SOLID RESIDUE.			Chlorine.	Sulphuric Acid, SO <sub>4</sub>	Lime.	Magnesia.	Color, &c.
	Fes.	Albuminoid.	Total.	Inorganic.	Organic and Volatile.	Total Residue					
Fresh Pond . . . . .	.0160	.0160	.0320	10.50	3.50	14.00					Slightly milky.
Fresh Pond Service, No. 9 Shepard St. .	.0046	.0060	.0106	9.00	3.50	12.50					Very slightly milky.
Spy Pond . . . . .	.0192	.0192	.0384	9.60	4.70	14.20					Small green specks in water.
Little Pond . . . . .	.0070	.0120	.0190	6.00	6.00	12.00	1.78	1.02	3.00	1.08	Clear, colorless.
Filter Basin . . . . .	.0050	.0064	.0134	14.00	4.50	18.50	3.09	1.19	5.00	2.16	"
Wellington Brook, near Gate House .	.0048	.0044	.0112	7.00	3.00	10.00					"
Wellington Brook, above the Piggery .	.0048	.0064	.0112	7.50	3.50	11.00					"
Crosby's Drain . . . . .	.0015	.0128	.0143	13.00	12.50	25.20					"
Crosby's Well . . . . .	.0019	.0206	.0265	36.00	6.60	42.50					"
Cochituate . . . . .	.0032	.0000	.0132	1.00	1.90	2.90					Yellowish.

TABLE II.

PARTS IN 100,000 PARTS OF THE WATER.

DATE.	SOURCE.	AMMONIA.			SOLID RESIDUE.			Chlorine.	Sulphuric Acid, SO <sub>3</sub>	Lime.	Magnesia.	Observer.
		Free.	Albuminoid.	Total.	Inorganic.	Organic and Volatile.	Total Residue at 212° F.					
1853 July . .	Fresh Pond . . . . .				8.51	2.31	10.83	1.95	.73	1.83	.63	M.
1872 Oct. . .	" . . . . .				16.49	5.00	21.49					H.
1873 " . . . . .	" . . . . .				9.72	4.03	13.77					H.
1875 Feb. 22	" " Top . . . . .	.0170	.0155	.0325	8.00	5.00	13.00	1.99	1.19	2.70	1.08	K.
1875 Feb. 22	" " Bottom . . . . .				9.00	5.00	14.00					K.
1875 Mar. 12	" " Service . . . . .				9.00	4.00	13.00					K.
1875 June 2	" " " . . . . .	.0010	.0050	.0060	11.00	3.00	14.00					K.
1875 June 16	" " " . . . . .	.0010	.0050	.0060	9.50	3.00	12.50					K.
1876 Mar. 13	" " " . . . . .	.0048	.0086	.0134	10.00	4.20	14.20					K.
1876 Dec. 16	" " " . . . . .	.0048	.0086	.0134	9.00	3.50	12.50					K.
1876 Dec. 13	" " " Top . . . . .	.0160	.0160	.0320	10.50	3.50	14.00					K.
1876 June 16	" " " Top . . . . .	.0050	.0120	.0170	9.50	4.50	14.00					K.
1875 Alewife Brook . . . . .	" " " Top . . . . .				9.50	6.40	16.00					H.
1870 Spy Pond Outlet . . . . .	" " " Top . . . . .	.0124	.0217	.0341	12.00	5.00	17.00	2.53	1.02	3.50	1.22	H.
1875 Feb. 22	" " " Bottom . . . . .				12.00	5.00	17.00					K.
1875 Feb. 22	" " " Top . . . . .	.0060	.0000	.0160	11.70	3.00	14.70					K.
1875 June 16	" " " " . . . . .	.0192	.0192	.0384	9.50	4.70	14.20					K.
1876 Dec. 13	" " " " . . . . .	.0016	.0110	.0126	8.70	4.50	13.20					K.
1875 June . .	Little Pond, Top . . . . .	.0070	.0120	.0190	8.00	6.00	14.00	1.73	1.02	3.00	1.08	K.
1876 Dec. 13	" " " " . . . . .	.0054	.0231	.0485	12.00	6.00	18.00	2.21	1.27	5.00	2.88	K.
1876 Aug. 9	Filter Basin . . . . .	.0040	.0054	.0134	14.00	4.50	18.50	3.03	1.19	5.00	2.16	K.
1876 Dec. 13	" " " " . . . . .	.0064	.0064	.0128	13.20	6.8	20.00	1.92	.68	4.00	1.93	K.
1876 Mar. 13	Springs in Little Pond . . . . .	.0128	.0120	.0248	13.40	6.6	20.00	2.57	.51	4.50	1.62	K.
1876 Mar. 13	" " " " . . . . .	.0088	.0080	.0168	18.00	4.5	22.50	2.60	0.00	5.00	1.20	K.
1876 Mar. 13	" " " " . . . . .	.0040	.0040	.0110	7.50	3.00	10.50					K.
1875 June 16	Wellington Brook . . . . .	.0043	.0064	.0112	7.50	3.50	11.00					K.
1876 Dec. 13	" " " " above Pig-pen . . . . .											K.



TABLE II.—*Continued.*  
PARTS IN 100,000 PARTS OF THE WATER.

DATE.	SOURCE.	AMMONIA.			SOLID RESIDUE.			Chlorine.	Sulphuric Acid, SO <sub>3</sub>	Lime.	Magnesia.	Observer.
		Free.	Albuminoid.	Total.	Inorganic.	Organic and Volatile.	Total Residue at 212° F.					
1873 Dec. 13	Wellington Brook, below Fig-pen	.0043	.0004	.0112	7.00	3.00	10.00					S. B.
1874 June 16	Myrtle, at Gate-house	.0033	.0100	.0133	5.20	4.50	9.70					W. S. B.
1874 Sept. 17	"	.0064	.0230	.0344	5.00	9.40	14.40	2.60				H. N.
1874 June 13	"	.0134	.0204	.0378	6.49	4.85	11.34	2.02				N. S.
1873 July 4	Cochituate	.0031	.0120	.0153	8.42	2.04	10.46	.34				N. S.
1874 May 16	" Office, 114 State Street.	.0040	.0120	.0160	2.10	2.40	4.50					N. S.
1875 June 16	" Pond	.0032	.0032	.0064	3.00	4.00	7.00					N. S.
1875 June 15	" Office, 114 State Street.	.0010	.0070	.0080	4.00	1.50	5.50					N. S.
1876 Dec. 15	"	.0032	.0100	.0132	1.60	1.90	3.50					N. S.
1876 Dec. 1	" Institute Technology	.0035	.0113	.0148	2.84	2.06	4.90					N. S.
1874 Jan. 1	Merrimack at Lowell, 100 feet from Shore	.0053	.0100	.0153	2.48	2.00	4.48	.20				N. S.
1874 Jan. 1	Merrimack at Lowell, from Filter-basin	.0061	.0037	.0100	5.20	1.20	6.40	.26				N. S.
1874 Jan. 2	Merrimack as delivered in Lowell	.0037	.0014	.0071	6.28	1.24	7.52	.30				N. S.
1873 Dec. 16	Charles River, Waltham	.0040	.0164	.0224	3.63	1.64	5.27	.40				N. S.
1873 Dec. 16	" Filter basin	.0017	.0055	.0103	5.60	0.91	6.51	.55				N. S.
1873 Dec. 16	" Reservoir	.0049	.0049	.0098	5.32	0.84	6.16	.36				N. S.
1873 Dec. 16	" House-service	.0020	.0013	.0033	5.60	0.04	5.64	.34				N. S.
1875 June 16	Drain in Crosby's Field	.0010	.0039	.0100	22.00	14.50	36.50		2.08	1.63	.91	S. S.
1876 Dec. 11	"	.0015	.0128	.0147	13.00	12.50	25.50					S. S.
1876 Dec. 13	Well in Crosby's Kitchen	.0010	.0000	.0100	30.00	6.90	42.90					S. S.
1876 Jan. 19	Schuykill	.0145	.0007	.0012	8.68	2.31	11.90	.65				U. C.

**TABLE III.**  
**PARTS IN 100,000 PARTS OF THE WATER.**

THAMES WATER COMPANIES.	AMMONIA.			SOLID RESIDUE.			Chlorine.	Sulphuric Acid, SO <sub>3</sub> .	Lime.	Magnesia.
	Free.	Albuminoid.	Total.	Inorganic.	Organic and Volatile.	Total.				
Grand Junction . . . . .	.0000	.0114	.0114			29.14	1.34	2.57	11.84	0.55
West Middlesex . . . . .	.0000	.0114	.0114			29.18	1.43	2.37	11.52	0.67
Southwark. . . . .	.0014	.0114	.0128			23.86	1.43	2.18	12.76	0.67
Chelsea . . . . .	.0000	.0100	.0100			29.86	1.43	2.47	11.93	0.67
Lambeth. . . . .	.0014	.0100	.0114			28.56	1.43	2.47	11.61	0.63

Yours respectfully,

STEPHEN P. SHARPLES, S.B.

114 STATE STREET, BOSTON, Dec. 17, 1876.

# REPORT

OF

## THE WATER REGISTRAR.

WATER REGISTRAR'S OFFICE,  
CAMBRIDGE, Dec. 11, 1876.

TO THE WATER BOARD.

THE undersigned herewith presents his Report of the receipts, expenditures, and abatements for the year ending Nov. 30, 1876, together with a statement of the number of water-takers, fixtures, &c., and other matters in his department.

Receipts.			
Water Rates . . . . .	\$117,202	21	
Meter Rates . . . . .	25,506	98	
City Rates . . . . .	10,837	87	
			\$153,547 01
Water Rates for 1875 . . . . .	6,831	46	
Meter Rates for 1875 . . . . .	1,655	52	
City Rates for 1873-75 . . . . .	17,132	77	
			25,619 75
			\$179,166 76 .
Supply-pipe, laying and repairing . . . . .	8,075	02	
Fines, off and on Water, and Sundries . . . . .	570	50	
Rent of House at Pipe-yard . . . . .	150	00	
Total . . . . .	\$187,962	28	
Amount paid to the City Treasurer . . . . .	187,402	53	
Balance (memoranda of A. F. Fifield) . . . . .	\$559	75	

**Expenditures.**

<b>Care and Repair Account; viz., —</b>					
General Repairs	.	.	.	\$6,806	54
Pumping Service	.	.	.	15,638	33
Office Expenses	.	.	.	6,141	78
					<hr/>
					\$28,586 65
Extension Account	.	.	.	.	104,143 11
Supply Account	.	.	.	.	7,071 52
					<hr/>
Total	.	.	.	.	\$139,801 28

**Due and Unpaid.**

Water Rates	.	.	.	.	.	.	\$3,685 00
Meter Rates	.	.	.	.	.	.	5,047 09
City Rates	.	.	.	.	.	.	1,225 00
Supply-pipe and Repairs, Sundry Parties	.	.	.	.	.	.	12,268 80
Supply-pipe and Repairs, City	.	.	.	.	.	.	4,408 08
							<hr/>
Total	.	.	.	.	.	.	\$26,633 97

Statement of the yearly revenue received from water-rates since the purchase of the works by the city: —

From April 28, 1865, to Dec. 1, 1865	.	.	.	\$32,367 19
“ Dec. 1, 1865, “ 1866	.	.	.	40,073 27
“ “ 1866, “ 1867	.	.	.	52,733 62
“ “ 1867 “ 1868	.	.	.	63,747 42
“ “ 1868 “ 1869	.	.	.	76,149 30
“ “ 1869 “ 1870	.	.	.	92,606 95
“ “ 1870 “ 1871	.	.	.	111,782 65
“ “ 1871 “ 1872	.	.	.	127,201 30
“ “ 1872 “ 1873	.	.	.	146,117 32
“ “ 1873 “ 1874	.	.	.	153,634 27
“ “ 1874 “ 1875	.	.	.	138,880 37
“ “ 1875 “ 1876	.	.	.	153,547 01
Arrears, 1873 “ 1875	.	.	.	25,619 75

The Report of the Water Registrar for year ending Nov. 30, 1875, showed amounts due from the city for 1873, 1874, and 1875, for fire hydrants, reservoirs, and watering streets, a total of . . . \$38,649 54

The City Council subsequently amended the Ordinance in relation to Water-Works, making special rates to the city, as follows: reducing rates for water for watering streets from three cents to one cent and a half per hundred gallons, and reducing the rate per hydrant (or reservoir) from \$30 to \$11, thereby causing a total reduction of . . . 21,516 77

Balance paid . . . . . \$17,132 77

A further reduction has been made this year by the discontinuance of 15 of the 29 reservoirs included in the above.

A careful examination of all premises supplied with Fresh Pond water was made early in the year, and a revision of the office-list of fixtures was made in accordance therewith, largely to the benefit of the city: but some errors in transfer in opening new books, consequent upon change of Registrar; a large number of fixtures subsequently removed by the owners; and the stringency of the times and the numerous vacant houses and tenements causing many owners to order water shut off, — have resulted in abatements to the amount of \$12,840.48; and water-rates paid, have, for the latter reasons, been refunded to the amount of \$713.37.

In the last Report there were remaining off for non-

payment of Rates . . . . .	130
Let on in 1876 . . . . .	21
	— 109
Shut off in 1876 (for non-payment, or per order of owners on account of vacancy) . . . . .	414
Let on again . . . . .	229
	— 185
Still remaining off . . . . .	294

The question as to allowance for vacant tenements in houses occupied by more than one family, and unused fixtures in single houses, as also the numerous cases where single supplies do

duty for double houses, and sometimes for whole blocks, have proved quite perplexing; and a necessary enforcement of the ordinance has caused some individual hardships. But most of such cases are now provided for by the seal-lock invented by Mr. John Miller, the foreman of the Supply and Repair Department, and, by approval of the Board, at once placed in use.

250 new supplies have been laid during the year; but some of them are not yet in use.

6 meters have been removed during the year, and 16 have been set.

The total number of meters now in use is 105, located as follows; viz.:—

WHERE ATTACHED.	SIZE OF METERS.						
	1-in.	1-1/2-in.	2-in.	2-1/2-in.	3-in.	3-1/2-in.	4-in.
A. H. Hews & Co., Pottery . . . . .				1			
American Net and Twine Co. . . . .				1			
American Ship Chandlery Co. . . . .					1		
Beck Hall, Mrs. Moering . . . . .				1			
Boston & Albany R. R. . . . .				1			
Boston & Lowell R. R. . . . .				1	3		
Boston Chemical Works . . . . .				1			
Boston Rolling Mill . . . . .					1		
Boston Stamping and Manufacturing Co. . .					1		
Boston Car Wheel Co. . . . .				1			
Boynton Packing Co. . . . .					1		
Brown & Nichols, Planing Mill . . . . .				1			
Blake Hose Association . . . . .		1					
Botanic Garden . . . . .			1				
Brannan, Shaw, & Co., Furniture Manuf . .				1			
B. P. Clark & Co., Confectioners . . . . .				1			
City of Cambridge . . . . .					2		
City of Cambridge, Almshouse . . . . .					1		
C. L. Jones & Co., Soap Manufactory . . . .		1					
C. A. French, Hotel . . . . .			1				
Cambridge Gas Light Co. . . . .					1		
Cartle Davis, Soap Manufactory . . . . .				1			
Dover Stamping Co. . . . .		1	1				
D. G. Pratt, Wood Turner . . . . .			1				
D. Osborn Estate, Planing Mill . . . . .					1		
Fitchburg R. R. . . . .					1		
F. Draper & Co., Stationers' Ware Manuf . .		1					
F. Geldowsky, Furniture Manuf. . . . .				1			
G. G. Page & Co., Box Factory . . . . .							
Geo. Woods & Co., Organ Manufactory . . .					1		
Geo. A. Denham & Co., Picture Frame Manuf.			1		1		
Geo. M. Rogers, Tenement Block . . . . .						1	

WHERE ATTACHED.	SIZE OF METERS.					
	1/2-in.	3/4-in.	1-in.	1 1/2-in.	2-in.	3-in.
House of Correction . . . . .					1	
H. O. Houghton & Co., Riverside Press . . . . .	1	1				
Harvard Laundry . . . . .	1					
Henry Thayer & Co., Man'g Pharmacutists . . . . .					1	
Hancock & Greely, Planing Mill . . . . .				1		
Hale Teale, & Bisbee, Soap Manufactory . . . . .			1			
H. M. Clark, Private Stable . . . . .	1					
H. M. Wyeth, Brick Yard . . . . .			1			
Harvard College . . . . .	1	2	2			
" " Boat House . . . . .	1					
" " Memorial Hall . . . . .					1	
Holyoke House . . . . .					1	
J. P. Squire & Co., Pork Packers . . . . .			1		2	
John Wilson & Son, Printers . . . . .			1			
John Reardon & Sons, Soap Manufactory . . . . .	1					
John B. Wood, Dredging Machine . . . . .					1	
John L. Sands, Brick Yard . . . . .			1			
James C. Davis & Son, Soap Manufactory . . . . .			1			
Leonard Cox, Laundry . . . . .			1			
Little, Brown, & Co., Book Bindery . . . . .			1			
Low & Knight, Tannery . . . . .				1		
Mt. Auburn Cemetery . . . . .				2	1	
Mason & Hamlin, Organ Manufactory . . . . .	1	2				
Middlesex Bleachery . . . . .	1					
New England Glass Co. . . . .					1	
New England Brick Co. . . . .				1		
O. S. Bullock, Machinist . . . . .			1			
Oleomargarine Factory . . . . .			1			
Pettingill & Rider, Cider Manufactory . . . . .	1					
Prospect House . . . . .				1		
Revere Sugar Refinery . . . . .						1
Reversible Collar Co. . . . .			1			
Russell & Dimick, Barrel Factory . . . . .	1					
Sortwell & Co., Distillers . . . . .					1	
Standard Ammonia Co. . . . .	1					
Sylvester Tower, Piano-Forte-Key Maker . . . . .			1			
S. M. Cofran, Brick Yard . . . . .					1	
St. Mary's Church . . . . .	2				1	
Union Glass Co. . . . .			2			
Union Railway Co. . . . .	3	3	2	2		
Woodbury & Co., Planing Mill . . . . .					1	
Welch, Juelow, & Co., University Press . . . . .	1					
Walworth Manufacturing Co. . . . .				1		
	21	33	20	29	2	



ter is now supplied to

10,262 Families.

720 Stables.

376 Shops, Stores, Offices, &c. (in addition to those above enumerated as supplied by meter), by the following fixtures:—

12,257 Faucets.

3,170 Wash Basins.

1,680 Wash Tubs.

1,724 Bath Tubs.

3,794 Pan Closets.

13 Door Closets.

446 Slop Closets.

32 Hopper Closets.

56 Urinals.

79 Yard Hydrants.

13 Fountains.

1,075 Hose.

5 Tumbler Washers. Exclusive of the Schoolhouses, Engine-Houses, Police Stations, and other City buildings, using the additional number of

76 Faucets.

30 Wash Basins.

4 Bath Tubs.

5 Urinals.

31 Pan Closets.

12 Door Closets.

5 School Closets, 114 Seats.

4 School Urinals, 417 Jets.

49 School Sinks, 239 Jets.

6 Stables.

6 Hose.

1 Steam Engine.

560 Fire Hydrants.

14 Fire Reservoirs.

17 Drinking-Fountains.

4 Garden Hydrants.

Respectfully submitted.

J. WARREN COTTON, *Registrar*

REPORT  
OF THE  
COMMITTEE ON ACCOUNTS OF THE WATER BOARD.

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IN CAMBRIDGE WATER BOARD,  
December, 1876.

THE Standing Committee on Accounts submits the following

REPORT.

We have examined the books and accounts of the Water Registrar, J. Warren Cotton, to the end of the financial year, Nov. 30, 1876, and compared them with the vouchers, and find that the same are correct.

J. WARREN MERRILL, }  
FRANK A. ALLEN, } Committee

# REPORT

## OF THE

### SUPERINTENDENT OF THE WATER-WORKS.

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CAMBRIDGE, DEC. 6, 1876.

TO THE PRESIDENT OF THE CAMBRIDGE WATER BOARD.

IN accordance with the city ordinance requiring the Superintendent, in the first week in December, to report the general condition of the works for the year ending Nov. 30, I would respectfully submit the following Report.

#### Water Supply and Ponds.

During the year, a cast-iron thirty-six-inch pipe has been laid to connect Spy Pond with Little Pond, and a gate-house has been erected at the Spy Pond end. A drain has been constructed to take the surface-water from the streets and low lands on the north-easterly side of Little Pond, around into Alewife Brook, to prevent it from flowing into the pond.

The conduit from Fresh Pond to Little Pond has been finished, and gate-houses built at Fresh Pond, Wellington Brook, and Little Pond, by which, in case of a short supply, the water can be let into Fresh Pond from other sources.

Black's Nook so called, in Fresh Pond, has been partly cleaned out, and much improved. The lower end of Fresh Pond has been greatly improved by digging out about eighteen acres to the depth of several feet; and the banks have been graded, and neatly paved with stone to a point above high-water mark. A gate-house has been built at the outlet of Fresh Pond at Alewife Brook, the gates in which have been kept constantly shut, to prevent the water from the brook running into the pond. A gate-house has also been built over the screen chamber, in the four-foot suction-pipe leading from the pond to our engine-house.

### **Engine-House, &c.**

The two pumps of the "Worthington" pattern are in good condition. They have a capacity of five million gallons each in twenty-four hours, and they are worked alternately, changing once a month. The daily average time of pumping is about ten hours and a half.

The engines have been kept in good running-order by our skilful engineer, Mr. E. C. Brooks, without any assistance from outside help. The engine and boiler rooms are kept clean and orderly. The two force main pipes from the engine-house to the reservoir are in good condition, no repairs having been required during the year.

The old engine and boiler houses, and coal-sheds, have all been taken down and removed.

### **Distributing Pipes.**

We have now in the city about ninety miles of pipes, — eighty-four miles of cast-iron pipe, and six miles of cement pipe. Most of this is laid in the public and accepted streets; but some is in streets and courts not accepted. Some pipes have been lowered during the year to prevent freezing.

### **Reservoir and Standpipe.**

The walls of the reservoir remain firm: they have been whitewashed, the walks around have been regravelled, and the grass banks have been properly cared for, and every thing about this attractive place is in good condition. The reservoir is seventy-seven feet, and the standpipe one hundred and twenty feet, above marsh level.

### **Hydrants.**

Thirty-six post hydrants have been set the past year, which, added to those previously set, make 372 flush, and 195 post hydrants, — in all, 567. We are using the Pattee and Perkins pattern, which give us the least trouble, and work to the entire satisfaction of the Chief Engineer of the Fire Department, who, under proper authority, has the locating of all hydrants. As fast as the flush hydrants get out of order, they are replaced by post hydrants.

**Meters, &c.**

We have 105 meters in good working-order applied on the premises of water-takers, all of which have been boxed and packed to prevent freezing. All the principal gates have been examined, and packed for the winter.

**Engines.**

The engines in the past year of 364 days have run 3,812 hours and 51 minutes ; a daily average of 10 hours, 29 minutes. There have been consumed 1,671,012 pounds of coal ; a daily average of 4,591 pounds. The engines have made in the year 2,954,792 revolutions ; a daily average of 8,117 revolutions. They have pumped during the year 887,637,600 gallons ; a daily average of 2,438,564 gallons.

The monthly supply and daily average are shown in the following table, covering fifty-two weeks : —

	Days.	Total Gallons per month.	Daily average per month.
December, 1875 . . . . .	35	83,335,200	2,381,006
January, 1876 . . . . .	28	68,374,200	2,441,935
February, " . . . . .	28	72,907,500	2,603,839
March, " . . . . .	35	88,067,700	2,516,220
April, " . . . . .	28	60,298,800	2,153,528
May, " . . . . .	28	62,992,800	2,249,743
June, " . . . . .	35	96,229,500	2,749,414
July, " . . . . .	28	85,680,300	3,060,010
August, " . . . . .	28	71,766,300	2,563,082
September, " . . . . .	35	83,145,000	2,375,571
October, " . . . . .	28	58,606,200	2,093,078
November, " . . . . .	28	56,234,100	2,008,360
	364	887,637,600	

**Drinking-Fountains.**

We have sixteen in use, all of which are now furnished with spring faucets to prevent the waste of water. They are located as follows : —

North Avenue, corner of Walden Street.  
 North Avenue, opposite Mechanics' Exchange.  
 Cambridge Common.  
 Harvard Square, opposite the store of Alfred Wood.  
 Brattle Square, opposite Brewer's Block.  
 Inman Square, junction Cambridge and Hampshire Street.  
 Cambridge Street, corner of Fifth Street.  
 Bridge Street, junction Cambridge Street.  
 Third Street, between Main Street and Broadway.  
 Hampshire Street, junction Broadway.  
 Broadway, corner Norfolk Street.  
 Lafayette Square, front of Universalist Church.  
 Central Square, opposite the store of D. U. Chamberlin.  
 Central Square, opposite the store of J. A. Holmes & Co.  
 Fort Washington.  
 Putman Avenue, corner Pearl Street.

#### Standpipes for Street Watering.

One has been removed from Main Street, West of Q, leaving thirty-four in use, located as follows:—

North Avenue, near the Common.  
 North Avenue, near Forest Street.  
 North Avenue, near Beech Street.  
 North Avenue, near Day Street.  
 Concord Avenue, junction Garden Street.  
 Near University Press.  
 Inman Street, near Broadway.  
 Broadway, corner Winsor Street.  
 Columbia Street, near Austin Street.  
 Green Street, near Western Avenue.  
 Cambridge Street, at Inman Square.  
 Cambridge Street, near Warren Street.  
 Gore Street, opposite Schoolhouse.  
 Otis Street, near Third Street.  
 Junction Bridge and Cambridge Streets.  
 Fifth Street, near Thorndike Street.  
 North Avenue, near Shepard Street.  
 Dana Street, corner Chatham Street.

Brattle Square, corner Sparks Street.  
 Broadway, corner Sixth Street.  
 Dublin Street, near Fitchburg Railroad.  
 Broadway, near Third Street.  
 Western Avenue, near Howard Street.  
 Third Street, near Rogers Street.  
 Main Street, near Portland Street.  
 Magazine Street, opposite Warland Street.  
 Main Street, near Hancock Street.  
 Kirkland Street, near Quincy Street.  
 Brattle Street, near Fayerweather Street.  
 Brattle Street, near Fresh Pond Lane.  
 Cambridge Street, near Winsor Street.  
 Mt. Auburn Street, near Athens Street.  
 North Avenue, near Spruce Street.  
 Brookline Street, corner Putnam Avenue.  
 Broadway, junction Hampshire Street.

**Galvanized Service-Pipe used during 1876.**

Diameter in Inches.	Number of Pipes.	Length in Feet.
2	6	600
1½	2	242
1½	1	80
1	7	810
¾	234	13,191
Total . . . .	250	14,923

The total number of supply-pipes is now 6,820.

**Brass Fittings used in 1876.**

2-inch Cocks	.	.	.	.	.	.	.	24
1½ " "	.	.	.	.	.	.	.	7
1½ " "	.	.	.	.	.	.	.	2
1 " "	.	.	.	.	.	.	.	14
¾ " Stop and Waste	.	.	.	.	.	.	.	272
Sidewalk Shut-off	.	.	.	.	.	.	.	285
Hose-bibb Cocks	.	.	.	.	.	.	.	41



## Garden Hydrants set in 1876.

On premises of water-takers . . . . .	5
Total number in use . . . . .	93

STATEMENT OF LOCATION, SIZE, AND NUMBER OF FEET  
OF MAIN PIPE LAID IN 1876.

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe
Acacia . . . . .	4	72
Berkshire . . . . .	4	160
Belmont . . . . .	6	16
Broadway . . . . .	8	24
Bath . . . . .	4	300
Cottage . . . . .	6	12
Channey . . . . .	4	50
Charles . . . . .	4	204
Connecting Spy Pond with Little Pond . . . .	36	950
College Grounds . . . . .	6	1,062
Dunster . . . . .	6	14
Decatur . . . . .	6	12
Elmwood Avenue . . . . .	12	765
Ellery . . . . .	6	52
Florence . . . . .	6	226
Fourth . . . . .	4	36
Fairfield . . . . .	6	336
Greenough Avenue . . . . .	4	36
George . . . . .	4	130
Hawthorne . . . . .	6	36
Hawthorne . . . . .	4	540
Lopez . . . . .	6	12
Mt. Auburn . . . . .	12	1,355
Mt. Auburn . . . . .	6	882
Main . . . . .	6	162
Montgomery . . . . .	6	110
North Avenue . . . . .	6	24
Oxford . . . . .	6	14
Otis . . . . .	4	20
Plymouth . . . . .	4	72
Pemberton . . . . .	6	840
Pleasant . . . . .	6	474
Pleasant . . . . .	12	75
Prescott . . . . .	4	320
Putnam Avenue . . . . .	16	670
Putnam Avenue . . . . .	6	75

STATEMENT OF LOCATION, ETC. — *Continued.*

IN WHAT STREET.	Diameter in Inches.	Feet of Pipe.
Richdale Avenue . . . . .	6	132
Somerset . . . . .	6	210
Somerset . . . . .	4	90
Sacramento . . . . .	6	912
Seckel . . . . .	6	40
Seckel . . . . .	4	150
Tannery Lane . . . . .	6	950
Western Avenue . . . . .	4	12
West . . . . .	6	321
West . . . . .	4	315
Watson . . . . .	4	12

RECAPITULATION OF MAIN PIPE LAID IN 1876.

950 feet . . . . .	36-inch.
870 " . . . . .	16 "
2,195 " . . . . .	12 "
24 " . . . . .	8 "
6,924 " . . . . .	6 "
2,519 " . . . . .	4 "

Total, 13,482 feet.

BLOW-OFF GATES SET IN 1876.

1 . . . . .	6-inch.
4 . . . . .	1½ "

REGULAR GATES SET IN 1876.

IN WHAT STREET.	Diameter in Inches.	Number.
Acacia . . . . .	4	1
Charles . . . . .	4	1
College Grounds . . . . .	6	2
Ellery . . . . .	6	1
Fourth . . . . .	4	3
Hawthorne . . . . .	6	1
Mt. Auburn . . . . .	12	2
Mt. Auburn . . . . .	6	6
Oxford . . . . .	6	1
Otis . . . . .	4	2
Pemberton . . . . .	6	1
Pleasant . . . . .	6	4
Pleasant . . . . .	12	1
Putnam Avenue . . . . .	16	1
Putnam Avenue . . . . .	6	4
Sacramento . . . . .	6	1

REGULAR GATES SET IN 1876. — *Continued.*

IN WHAT STREET.	Diameter in Inches.	Number.
Seckel . . . . .	6	1
Tannery Lane . . . . .	5	1
Tannery Lane . . . . .	4	1
Thorndike . . . . .	4	4
Western Avenue . . . . .	4	1

## RECAPITULATION.

1 . . . . .	16-inch.
2 . . . . .	12 "
23 . . . . .	6 "
13 . . . . .	4 "

---

 Total, 40

## GATES CLEANED OUT IN 1876.

IN WHAT STREET.	Diameter in Inches.	Number.
Bath . . . . .	1½	1
Brighton . . . . .	6	2
Brattle Square . . . . .	6	1
Beacon . . . . .	1½	1
Belmont . . . . .	1½	1
Berkshire Place . . . . .	1½	1
Chestnut . . . . .	1½	1
Charles . . . . .	1½	1
Creek . . . . .	1½	1
Eliot . . . . .	6	1
Greenough Avenue . . . . .	1½	1
Green . . . . .	6	7
Harvard . . . . .	6	8
Magazine . . . . .	6	1
Montgomery . . . . .	1½	1
Meacham . . . . .	1½	1
Main . . . . .	6	1
Main . . . . .	8	1
Pacific . . . . .	1½	1
Plymouth . . . . .	1½	1
Putnam Avenue . . . . .	6	3
Portland . . . . .	6	1
Richdale Avenue . . . . .	1½	1
South . . . . .	1½	1
State . . . . .	6	1
Somerset . . . . .	1½	1

**STATEMENT**  
**OF STOCK ON HAND DEC. 1, 1876.**

**Galvanized Pipe.**

250 feet 2-inch.	4,000 feet $\frac{3}{4}$ -inch.
300 feet $1\frac{1}{2}$ -inch.	200 feet 1-inch.
200 feet $1\frac{1}{4}$ -inch.	

**Fittings for Service-Pipes.**

14 1-inch Hose Bibbs.	15 $2 \times 1\frac{1}{2}$ -inch T's.
6 $\frac{3}{4}$ -inch Hose Bibbs.	10 $2 \times 1$ -inch T's.
40 $\frac{3}{4}$ -inch Compression Bibbs.	10 $1\frac{1}{2}$ -inch T's.
2 $1\frac{1}{2}$ -inch Screw Cocks.	20 $1\frac{1}{2} \times 1\frac{1}{2}$ -inch T's.
20 1-inch Screw Cocks.	10 1-inch T's.
60 $\frac{3}{4}$ -inch Screw Cocks.	2 $\frac{3}{4}$ -inch T's.
100 1-inch Sidewalk Cocks.	30 $1\frac{1}{2}$ -inch T's.
12 $\frac{3}{4}$ -inch Sidewalk Cocks.	15 $1\frac{1}{2} \times 1$ -inch T's.
50 1-inch M. & F. Cock for Cement Pipe.	10 $1\frac{1}{2} \times \frac{3}{4}$ -inch T's.
1 $1\frac{1}{2}$ -inch Blow-off Cock.	20 1-inch T's.
12 $\frac{3}{4}$ -inch Corporation Cocks.	100 $\frac{3}{4}$ -inch T's.
6 2-inch Corporation Cocks.	100 $\frac{3}{4} \times \frac{1}{2}$ -inch T's.
10 $1\frac{1}{2}$ -inch Corporation Cocks.	20 $\frac{1}{2}$ -inch T's.
1 1-inch Corporation Cock.	30 $1\frac{1}{2}$ -inch Elbows.
1 2-inch Stop and Waste Cock.	25 $1\frac{1}{2}$ -inch Elbows.
2 $1\frac{1}{2}$ -inch Stop and Waste Cocks.	20 1-inch Elbows.
1 $1\frac{1}{2}$ -inch Stop and Waste Cock.	100 $\frac{3}{4}$ -inch Elbows.
31 1-inch Stop and Waste Cocks.	20 $\frac{1}{2}$ -inch Elbows.
20 $\frac{3}{4}$ -inch Stop and Waste Cocks.	25 1-inch Street Elbows.
6 $\frac{3}{4}$ -inch Hose Nipples.	100 $\frac{3}{4}$ -inch Street Elbows.
12 Gate Spindles.	15 2-inch Couplings.
40 2-inch T's.	15 $1\frac{1}{2}$ -inch Couplings.
	6 $1\frac{1}{2}$ -inch Couplings.
	50 1-inch Couplings.
	50 $\frac{3}{4}$ -inch Couplings.
	100 $\frac{1}{2}$ -inch Couplings.
	10 1-inch Air Chambers.
	20 $\frac{3}{4}$ -inch Air Chambers.

100 $\frac{1}{2}$ -inch Air Chambers.	15 1-inch Nipples.
10 $1\frac{1}{2}$ -inch Unions.	20 $\frac{3}{4}$ -inch Nipples.
8 $1\frac{1}{4}$ -inch Unions.	80 $\frac{1}{2}$ -inch Nipples.
10 1-inch Unions.	2 2-inch Plugs.
50 $\frac{3}{4}$ -inch Unions.	4 $1\frac{1}{2}$ -inch Plugs.
25 1-inch Clips.	2 $1\frac{1}{4}$ -inch Plugs.
20 $\frac{3}{4}$ -inch Clips.	4 1-inch Plugs.
10 $\frac{1}{2}$ -inch Clips.	12 $\frac{3}{4}$ -inch Plugs.
10 2-inch Crosses.	6 $\frac{1}{2}$ -inch Plugs.
20 $2\times 1\frac{1}{2}$ -inch Crosses.	6 $2\times 1\frac{1}{2}$ -inch Bushings.
20 $2\times 1$ -inch Crosses.	6 $2\times 1\frac{1}{4}$ -inch Bushings.
25 $1\frac{1}{2}$ -inch Crosses.	4 $2\times 1$ -inch Bushings.
25 $1\frac{1}{2}\times 1\frac{1}{4}$ -inch Crosses.	6 $2\times \frac{3}{4}$ -inch Bushings.
25 $1\frac{1}{2}\times 1$ -inch Crosses.	5 $1\frac{1}{2}\times 1\frac{1}{4}$ -inch Bushings.
30 $1\frac{1}{2}\times \frac{3}{4}$ -inch Crosses.	3 $1\frac{1}{2}\times 1$ -inch Bushings.
20 $1\frac{1}{4}$ -inch Crosses.	4 $1\frac{1}{2}\times \frac{3}{4}$ -inch Bushings.
18 $1\frac{1}{4}\times 1$ -inch Crosses.	5 $1\frac{1}{4}\times 1$ -inch Bushings.
8 $1\frac{1}{4}\times \frac{3}{4}$ -inch Crosses.	4 $1\frac{1}{4}\times \frac{3}{4}$ -inch Bushings.
6 1-inch Crosses.	8 $1\times \frac{3}{4}$ -inch Bushings.
4 $1\times \frac{3}{4}$ -inch Crosses.	10 $\frac{3}{4}\times \frac{1}{2}$ -inch Bushings.
150 $\frac{3}{4}$ -inch Socket Ends.	30 1-inch Lock Nuts.
2 Garden Hydrants.	20 $\frac{3}{4}$ -inch Lock Nuts.
20 2-inch Nipples.	15 $\frac{1}{2}$ -inch Lock Nuts.
15 $1\frac{1}{2}$ -inch Nipples.	6 $\frac{3}{8}$ -inch Lock Nuts.
15 $1\frac{1}{4}$ -inch Nipples.	

#### Stock at the Pipe Yard.

24 feet 48-inch Pipe.	1 20 to 10-inch Cross.
260 feet 30-inch Pipe.	1 16 to 12-inch Cross.
300 feet 24-inch Pipe.	1 12-inch Cross.
50 feet 16-inch Pipe.	4 12 to 10-inch Crosses.
200 feet 20-inch Pipe.	7 12 to 6-inch Crosses.
30 feet 12-inch Pipe.	5 12 to 4-inch Crosses.
2,000 feet 10-inch Pipe.	2 10 to 10-inch Crosses.
1,800 feet 8-inch Pipe.	2 10 to 8-inch Crosses.
1,800 feet 6-inch Pipe.	7 10 to 6-inch Crosses.
1,500 feet 4-inch Pipe.	2 8 to 8-inch Crosses.
1 24 to 10-inch Cross.	2 8 to 6-inch Crosses.
1 20-inch Cross.	2 8 to 4-inch Crosses.

15 6 to 6-inch Crosses.	1 20 to 10-inch T.
6 6 to 4-inch Crosses.	2 20 to 6-inch T's.
10 4-inch Crosses.	1 12 to 12-inch T.
2 30-inch Sleeves.	10 12 to 6-inch T's.
4 24-inch Sleeves.	1 12 to 8-inch T.
3 20-inch Sleeves.	20 10 to 6-inch T's.
4 16-inch Sleeves.	22 8 to 6-inch T's.
6 12-inch Sleeves.	6 6-inch T's.
6 10-inch Sleeves.	4 6 to 4-inch T's.
10 8-inch Sleeves.	15 4 to 4-inch T's.
20 6-inch Sleeves.	1 24 to 10-inch Reducer.
8 4-inch Sleeves.	1 24 to 12-inch Reducer.
6 3-inch Sleeves.	cer.
5 24-inch Clamp Sleeves.	1 20 to 10-inch Reducer.
3 12-inch Clamp Sleeves.	1 20 to 12-inch Reducer.
3 10-inch Clamp Sleeves.	1 20 to 8-inch Reducer.
5 8-inch Clamp Sleeves.	1 16 to 6-inch Reducer.
2 6-inch Clamp Sleeves.	1 12 to 8-inch Reducer.
3 4-inch Clamp Sleeves.	1 12 to 6-inch Reducer.
3 3-inch Clamp Sleeves.	8 10 to 6 Reducers.
1 30-inch Bend.	6 8 to 6-inch Reducers.
2 24 $\frac{1}{2}$ -inch Bends.	3 6 to 4-inch Reducers.
2 24 $\frac{1}{8}$ -inch Bends.	1 4 to 3-inch Reducer.
2 20-inch Bends.	2 20-inch Caps.
1 16-inch Bend.	8 12-inch Caps.
2 12-inch Bends.	2 6-inch Caps.
10 10-inch Bends.	5 4-inch Caps.
15 6-inch Elbows.	6 10-inch Offsets.
2 Go-Over Drains.	12 6-inch Offsets.
15 6-inch Elbows.	6 4-inch Offsets.
2 20 to 6-inch Blow-Offs.	1 12-inch Gate.
5 10 to 6-inch Blow-Offs.	1 10-inch Gate.
1 12 to 6-inch Blow-Off.	1 8-inch Gate.
1 24-inch T.	1 6-inch Gate.
1 24 to 8-inch T.	4 4-inch Gates.
5 24 to 6-inch T's.	2 3-inch Gates.
3 20 to 20-inch T's.	1 4-inch Meter.
1 20 to 12-inch T.	3 1-inch Meters.
5 16 to 6-inch T's.	5 $\frac{3}{4}$ -inch Meters.



5 Small Gates, Frames, and  
Covers.

1 24-inch Elbow.

1 10-inch Elbow.

6 6-inch Elbows.

1 24-inch Y Branch

1 12-inch Y Branch

2 24-inch Check Valves

12 Standpipes for shut-off  
Cocks.

#### Miscellaneous.

4 Flush Hydrants.

7 Post Hydrants.

175 Tons of Old Junk.

4 Wagons.

2 Hand Carts.

2 Horses.

2 Sets of Harnesses.

1 Pump.

1 Large Hand Pump.

1 Large Boom Derrick.

8 Small Derricks.

300 Pounds of Lead.

100 Pounds of Packing.

275 Shovels.

90 Picks.

100 Wheelbarrows.

4 Iron Bars.

4 Chains.

1 Dozen Lanterns.

1 Grindstone.

1 Platform Scale.

1 Pipe - Thread Cutting  
Machine.

1 Machine for Drilling

1 Dwelling-house for  
Master.

1 Stable and Shed.

1 Dwelling-house for  
Engineer.

And all the tools in the Engine-house requisite for repairs,  
likewise all the tools required for laying main pipes and  
pipes.

Respectfully submitted.

S. W. DUDLEY

*Sup.*



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City of Cambridge.

THE  
THIRTEENTH ANNUAL REPORT.

32015

OF THE

CAMBRIDGE WATER BOARD

TO

THE CITY COUNCIL,

TOGETHER WITH THE

REPORTS OF THE REGISTRAR AND SUPERINTEN-  
DENT, AND OTHER DOCUMENTS,

FOR THE YEAR 1877.



CAMBRIDGE:  
WELCH, BIGELOW, AND COMPANY,  
University Press.

1878.

☆ CAMBRIDGE PUB. LBRY



# REPORT

OF

## THE CAMBRIDGE WATER-BOARD.

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TO THE HONORABLE CITY COUNCIL OF THE CITY OF CAMBRIDGE.

IN accordance with the City Ordinance, the Cambridge Water Board herewith presents to you its Thirteenth Annual Report:—

### Total Cost of the Works.

Cost of the Water-Works, November 30, 1876, as per last year's Report . . . . .	\$ 1,656,710.31
Expended for extension account for the year ending November 30, 1877 . . . . .	15,881.98
Making the total cost, November 30, 1877 . . . . .	\$ 1,672,592.29

### Net Cost of the Water-Works.

Amount of total cost as above . . . . .	\$ 1,672,592.29
Less amount of water debt paid from the sinking-fund to June 30, 1876 . . . . .	186,100.00
Leaving amount of water debt unpaid . . . . .	\$ 1,486,492.29
Deduct from this the amount of the sinking-fund to June 30, 1876, as per Treasurer's account . . . . .	\$ 179,441.23
Gain in 1877, to November 30 . . . . .	57,062.36
	<hr/>
	\$ 236,503.69
Showing about the net cost of the Water-Works, November 30, 1877.	<hr/>
	\$ 1,249,988 60



Statement in brief showing the transactions on account of the Water-Works for the year ending November 30, 1877:—

<b>Received.</b>	
Appropriation for extension account . . . . .	\$ 30,000.00
From water-rates . . . . .	\$ 158,078.11
Less water-rates refunded . . . . .	3,234.52
	<hr/>
	154,843.59
From supply account, shutting off and letting on water, and sale of old material . . . . .	8,191.70
Rent of house, etc. . . . .	151.25
Interest on sinking-fund . . . . .	9,313.63
Interest accrued on bonds sold, etc. . . . .	1,281.67
	<hr/>
	\$ 203,781.84
<b>Expended.</b>	
For extension account . . . . .	\$ 15,881.98
For care and repair . . . . .	22,612.44
For supply account . . . . .	4,107.04
For interest on water debt . . . . .	90,000.00
Unexpended appropriation . . . . .	14,118.02
Balance showing gain in 1877 . . . . .	57,062.36
	<hr/>
	\$ 203,781.84
<b>Comparative Receipts.</b>	
Water-rates for the year ending Nov. 30, 1876 . . . . .	\$ 179,166.78
Water-rates for the year ending Nov. 30, 1877 . . . . .	154,843.59
	<hr/>
Showing <i>decrease</i> for the year 1877 . . . . .	\$ 24,323.17

This large decrease from last year is partly explained by the fact that last year, \$ 17,132.77 was included in our account received from the City for water furnished in *previous years*, while \$ 4,357.50 due for water furnished the City this year was not approved in time to include in this year's accounts.

The following table will show the comparative rainfall and the height of water in the pond during the past three years. We are this year, as in former years, indebted to officers of the Cambridge Observatory for the table of rainfall:—

	Rainfall.			Below High-Water Mark.					
	1875.	1876.	1877.	1875.		1876.		1877.	
	in.	in.	in.	ft.	in.	ft.	in.	ft.	in.
	1.50	1.04	5.09	5	9	6	1 $\frac{1}{2}$	4	7
	3.22	1.82	3.87	6	6	5	6	4	6
	3.54	4.74	0.89	7	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	4	2 $\frac{1}{2}$
	8.10	6.53	7.46	6	7 $\frac{1}{2}$	5	1 $\frac{1}{2}$	2	0
	4.73	4.65	3.66	5	7	4	1 $\frac{1}{2}$	0	8 $\frac{1}{2}$
	3.08	3.07	3.58	5	5	3	8 $\frac{1}{2}$	0	11 $\frac{1}{2}$
	6.60	1.92	2.26	4	2 $\frac{1}{2}$	4	0 $\frac{1}{2}$	1	9
	2.88	6.08	2.66	5	8 $\frac{1}{2}$	4	11 $\frac{1}{2}$	2	8 $\frac{1}{2}$
	5.66	1.38	4.58	6	0 $\frac{1}{2}$	5	4 $\frac{1}{2}$	3	6 $\frac{1}{2}$
	3.22	3.77	0.51	6	4 $\frac{1}{2}$	5	8 $\frac{1}{2}$	4	3 $\frac{1}{2}$
	3.83	1.82	6.77	6	0	6	5 $\frac{1}{2}$	4	6 $\frac{1}{2}$
	4.86	6.78	7.60	5	9 $\frac{1}{2}$	5	1 $\frac{1}{2}$	3	11
Total	51.46	43.60	48.93	Aver. 5 10		5 1 $\frac{1}{2}$		3 1 $\frac{1}{2}$	

\* This is in each case the December of the previous year.

be seen by this table that the average height of the water and during the past year has been about two feet higher than two previous years, and that too when the amount of water pumped the last year has been above the average of the three previous years, and the rainfall about the same. This is accounted for by water coming through the new conduit, from the filter-basin at the Pond, and from Wellington Brook. We start the new year with about two feet more water in the pond than one year ago, containing about 110,000,000 gallons.

#### Work Done.

The amount expended the past year on our extension account has been the smallest for many years. No large outlays were needed, as the work contemplated was not done, being that of making a dam to purify the water that came into the pond from the Street district. This plan, referred to in our last Annual Report, was, after a careful examination by our City Engineer, pronounced impracticable, and was therefore abandoned.

Most of the work done has been in renewing pipes in regions where the original pipes had decayed or become too small for the wants of the water-takers, and to furnish also a good supply

for fire purposes, and in raising and renewing pipes in the filled districts.

#### **Purity of our Water.**

Much attention has been devoted the past year to finding and removing sources of pollution to our water. In this direction a beginning was made at Richardson's Piggery, of which so much has been said. The lower pens nearest the brook have been removed, and the ditch leading from Wellington Brook to a point near the piggery has been filled up solid its whole length, and a dike has been thrown up at the foot of the upland on the edge of the meadow, so that we do not expect any further just complaint from this source of trouble.

The line of Wellington Brook was then followed up into Belmont, and the objectionable house-drainage and privies which were spoken of in the Report of the City Engineer to us, which, by vote, we sent to you, October 5, last, have been provided for and remedied. Nearly all causes of complaint in this direction have been removed, and negotiations and other means at our command are being used to complete this work, and thus remove all reasonable cause of complaint in this direction.

A flume has been constructed at the Wellington Brook gate on our conduit; by this means we are able to control the water in the brook, and only let it into the conduit when it is in good condition for use.

No water has been taken during the year from Spy Pond, and none from Little Pond, except what passed through the filter-basin.

The greatest source of pollution to our water now by drainage into the pond is from the Cushing Street district in Belmont. This at times is very bad, and is growing worse every year. In times of heavy rains a large amount of very objectionable matter flows into the pond, over the low lands bordering on the pond on the southwest side. We think this subject has assumed such proportions that there is no justification for any longer delay in providing a remedy; and if this is not done our citizens will have just grounds of complaint.

After such examination of this subject as we have been able to make, we have come to the conclusion to recommend the construction of a sewer from a point near Cushing Street, thence along the

borders of the pond to the Watertown Branch Railroad, thence along the line of the railroad to Lexington Avenue, to connect there with the sewer already built.

A plan for such a sewer to carry away this drainage, at an estimated cost of \$9,345.58, was presented to you in the City Engineer's Report, before referred to. (Land damages, or right of way, not included.) This will be a continuance of the original plan for a marginal sewer around Fresh Pond, as set forth in our Report to you in the year 1872, and referred to in other Reports since.

At the proper time we shall ask for such an appropriation as will enable us to complete this work at the earliest moment.

During the past summer we had an unusual experience in the sudden appearance and very rapid increase of what proved to be a vegetable growth in our water.

It was first observed in the reservoir, August 22, in the form of a greenish scum on the water which emitted an offensive odor. The water seemed to be full of a substance which was constantly rising to the surface and forming a scum. A man was employed at the reservoir in removing this floating matter every day from its first discovery until it disappeared.

The presence of it in the water caused some complaint from the water-takers, and required a constant blowing off of the water at hydrants and dead-ends to abate the trouble as much as possible. At first it was feared that it was caused by the introduction of so large an amount of water into the pond from the new conduit, but examination proved that this was not the cause, as we found other water-supplies within a few miles as bad or worse than ours.

We had a careful examination and analysis of the water made by Professor Sharples, who sums up his report to us as follows: "In my opinion the unpleasant taste of the water is entirely due to the decay of certain algæ, and it will cease very soon. There is no evidence that this condition of the water is injurious to health; it is simply unpleasant. The analyses at the present time agree very closely with those made last winter."

It will be seen by what follows that Professor Sharples agrees with other eminent authorities in regard to the nature and harmlessness of this vegetable growth in the water.

So many inquiries were made about this subject of Professor Nichols, that October 1 he issued a circular on the subject, which



presents all that is at present known about it, in a concise and intelligent manner, and as it seems to us this is a subject of great importance to be understood by all interested, we embody in our Report his paper, to which we invite your careful consideration.

“CIRCULAR.

“MY DEAR SIR : —

“As I am often asked for information with reference to what is known about the nature and cause of the green material which during the summer-time fills the waters of many of our ponds, I have written out somewhat at length what is the actual state of our information in the matter.

“I take the liberty of sending you a copy of what I have written. I shall be very glad to receive any information or details as to the occurrence of similar growths in ponds, with which I am not familiar, and being interested in various matters relating to water-supply, I should esteem it a kindness if you would favor me with such reports as you may from time to time have at your disposal. I shall endeavor to reciprocate as far as I have opportunity.

“The appearance to which I refer is due to a vegetable growth ; not to the presence of particles of dead, decomposing, or decayed vegetable matter from the sides or bottom of the pond, but to the enormous development of one or more of several species of microscopic plants. The individual plants are in some cases distinguishable by the naked eye, but their form and structure can be made out only by use of the microscope. The number of individuals is almost infinite, and under favorable conditions they increase with great rapidity ; their presence gives a decidedly green or greenish-yellow tinge to large bodies of water, and their death and decay often cause considerable offence to the sense of smell of those sojourning in the neighborhood, and to the sense of taste of those obliged to drink the water.

“Yours respectfully,

“WM. RIPLEY NICHOLS.

“Mass. Inst. of Technology,  
Boston, Oct. 1, 1877.

“No natural water which is exposed to the air, whether in pond or river, is ever entirely free from vegetable growth, and to certain of these growths attention has been more frequently called of late, owing to the very considerable increase in the number of towns furnished with a supply of water taken from natural ponds of long standing, or from artificial reservoirs recently made, either by raising the level of a natural pond, or by damming some stream.

"The non-professional and non-botanical observer might very likely divide the various plants found growing in the water into three classes: 1st, and most readily recognized as plants, are those commonly known as eel-grass, pond-weed, pickerel-weed, lilies, etc., which have roots and leaves, and also, at the proper season, flowers; 2d, and less readily recognized as plants, are the confervoid growths,\* as they are often called, of filamentous structure, grass-green, or in some cases bluish-green in color, forming tangled masses readily removed from the water, and when so removed, shrinking enormously in apparent bulk and drying away to a grayish or colorless mass, in some cases looking almost like coarse paper. Plants of this character grow in almost all reservoirs, or other bodies of water exposed to the light and air, both in still and running water. These plants either float in masses in the water or grow attached more or less firmly to the rocks and stones of the bottom of the pond or reservoir. By their growth they do no harm to the water in which they flourish, and as they are readily arrested by ordinary wire screens, or readily removed by rakes or scoop-nets, their presence causes no serious inconvenience in water used for town supply. If detached and floating in the pond they readily drift to shore, so that when the ice is formed they are not likely to be frozen in and to injure the ice for the market.

"The third division of the non-professional would include those minute organisms which appear as greenish specks, or minute straight or curved threads, diffused through the water, visible enough if a large quantity of water be looked at, but perhaps almost escaping notice in the small quantity which would be taken up in a single glass. If collected together as a scum, which often happens, especially on the leeward shore of a pond, the scum is not coherent, is easily broken up, either by a wind setting in the opposite direction, by a shower of rain, or by artificial agitation. The appearance has been sometimes described as that of meal or of fine dust scattered through the water.

"While very many species of the minute algæ present this general appearance, as far as my own observation and information extend, the number of species which are known to increase to such a great extent as to completely fill the waters of ponds of many acres' area, and to cause sensible inconvenience, is comparatively small. The most common in this neighborhood (New England) seem to be the *Clathrocystis ceruginosa*; but certain plants referable to the *Nostochineæ* are not uncommon alone, or in company with the *Clathrocystis*.

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\* These, as well as those mentioned below, belong to the class of cryptogamous (non flowering) plants, which the botanists call algæ, — plants which grow in the water or in moist places, and usually contain chlorophyll (green coloring matter), or some allied substance. To their number and their variety there is almost no end.

"The inconvenience caused by the presence of the plant is felt first by those who use the water for town supply, and, secondly, by those who cut ice upon the pond. While the plant is alive and growing there is little taste or odor given to the water, hardly noticeable if the water be iced. When the plants enter into the first stage of decay, the water acquires a peculiar taste and odor. Light and a certain degree of temperature are requisite for the normal growth of these algæ, and the decay often takes place in the mains and service pipes: it will not unfrequently happen that the water in a reservoir or pond will have almost no taste, while the water as delivered to consumers will have a decided taste. By the settling of the green growth to the bottom in a more or less decayed state, the ponds are generally (?) cleared before the cold weather sets in, but in several cases which have come under my observation the material floats up to the under surface of the ice, and is frozen into the ice, making it unmarketable. I am collecting data, but have arrived at no satisfactory conclusion as to the circumstances under which this does or does not occur, for it does not happen every year even in the same pond, and after summers of equally abundant growth.

"Among the various questions which are often propounded with reference to the matter, are the following:—

"1. What is the cause of the trouble?

"2. Why do we (in this region) hear so much more about it than formerly?

"3. Is it injurious to health?

"4. Can anything be done to prevent it?

"1. *The cause of the trouble.*

"Although there is no doubt that the trouble is caused by minute vegetable organisms, of whose life history a good deal is known to botanists, various causes have been suggested for its appearance. By many it has been supposed to be a sort of fermentation, a process of purification. In some cases this abundant appearance of the green matter has seemed to follow the apparent increase of sewage and other impurities discharged into the pond. I have within the last few years examined a great many ponds affected in this way, and cannot satisfy myself that there is any connection between such discharge of sewage and the growth of these algæ; the amount of soluble nitrogenous matter, of ammoniacal salts, of phosphates, and of other mineral compounds necessary for their growth are everywhere present, and it would be unsafe to prophesy the security therefrom of any pond. Although it would seem that ponds recently made by flowing marshy or cultivated land were peculiarly liable to the trouble,



especially if shallow, my observations have led me to make even this statement less emphatic than I was at first inclined.

"Although these plants are not all killed by a considerable degree of cold, still they *thrive* only in warm weather. Observations on this point are incomplete, but such as I have been able to collect would seem to point to a temperature of 70° F., or thereabout, below which the trouble is not likely to begin; extended observations on this point are much needed.

"I have been unable to satisfy myself that the presence of aquatic plants at the margins of the ponds has other effect than that of entangling and holding masses of scum, which if then exposed to a hot summer sun rapidly enter into decay.

"Mr. George W. Carpenter, of the Albany Water-Works, has made the observation that in years when there is early in the season in his reservoirs a vigorous growth of certain *filamentous* algæ (which from the description probably are of some species of *Spirogyra*, or *Zygnema*), there is not any growth of the finer algæ, which in other years cause more or less trouble. I have met with other instances where the same thing has seemed to obtain; on the other hand, I have often found *Spirogyra* and other filamentous plants growing at the same time with the *Clathrocystis*. In Horn Pond, near Boston, there is generally in the spring a large amount of a plant which to the eye seems, except in color, very like the filamentous algæ referred to,\* and later in the season, for some years at least, there has been an abundant growth of the *Clathrocystis* and of an *Anabaena*.

"2. *Why do we (in this region) hear so much more about this growth than formerly?*

"One reason, at least, is to be found in the fact that the attention of more persons is called to the various ponds than formerly. It may be true, although hardly probable, that for the past five or six years there has been more of the growth in the aggregate than usual. There is no doubt that in the case of certain individual ponds there has been a decided increase; in other ponds there has been apparent decrease, others seem to be subject to irregular fluctuations in the amount from season to season.

"It is also to be remarked that little is generally said by those in charge of Water-Works with reference to such matters, as everything of

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\* This is the *Plectonema Wollei*, a plant of bluish-green color, belonging to the order of *Nostochineæ*, described by Dr. Farlow in the Bulletin of the Bussey Institution, Vol. II. (1876), p. 75.

the kind is apt to be exaggerated in the public prints, and often made capital of by political and other opponents, although the trouble may be entirely beyond the control of Water Board or Superintendent.

"The earliest Water Report with which I am acquainted that shows any clear conception of the nature of the trouble is the Report of the Croton Water Board, New York, 1859. The Albany Water Report for the year 1865 contains a very full account of the trouble as there experienced. From the figure given of the plant, I infer it to be a species of *Anabana*, similar to that which I have observed at Horn Pond and elsewhere.

"3. *Is the matter injurious to health?*

"The observations as to the effect on the human organism of water containing these algæ are not, of course, very definite or complete. In some places, however, where the only source of supply is thus affected, opportunity for observation is afforded. I have not been able to obtain any evidence of the unwholesomeness of the water from a supply which is, in other respects, of good quality. When the algæ are alive and fresh, horses and cattle drink the water readily, in preference to spring water; when decay has taken place, the water sometimes becomes so offensive that they refuse to drink it. In this condition it is manifestly unsuited for domestic use.

"4. *Can anything be done to prevent the trouble?*

"As far as our present knowledge extends, — nothing. The extent to which filtration of the water may mitigate the evil has been a matter of some experiments, and this point will be discussed at some length in the next Annual Report of the State Board of Health; I will therefore not forestall what I shall have to say in that place.

"In conclusion, I wish to be distinctly understood as not asserting that all bad tastes and odors to which water-supplies are subject are due to the presence of these or other algæ. They are the real cause of a real trouble. The occurrence of a *fishy, musty, cucumber, green-corn*, or other peculiar odor or taste, may be due to the presence or decomposition of certain algæ, but it may be produced by the decay of more highly organized plants, or by causes of which we are ignorant. For instance, the cucumber taste which affected the Chestnut Hill Reservoir of the Boston Water-Works, in 1875, was traceable to no such cause, nor indeed to any assignable cause, although careful examinations were made from a chemical, from a botanical, and from a zoological standpoint. Other cases also have come under my observation where no algæ, fresh or decomposed, could be found in sufficient quantity to account for the unpleasant taste which was very noticeable.

"I should say that, having begun the study of this matter some years since, I have been under obligations to many persons, to all of whom I am duly grateful, and of whom I should perhaps mention by name, Dr. W. G. Farlow, Assistant Professor of Botany in Harvard University, Geo. W. Carpenter, Esq., Superintendent of the Albany Water-Works, and The. W. Davis, Esq., Superintendent of the Poughkeepsie (N. Y.) Water-Works."

#### General Remarks.

We desire to express our great satisfaction at the energy and perseverance with which Mayor Allen has followed up the examination of the accounts of our late Registrar, and collected and presented the evidence of his wrong-doing, so as to bring justice to the front, and secure his conviction in the face of difficulties which would have discouraged a less earnest and conscientious man.

It may be proper here to remark that we have adopted a new system of keeping our accounts, which can be compared and checked off, so as to know whether all accounts are properly vouched for; and we have also provided that the yearly auditing shall be done by an expert, who goes over the whole year's work in detail.

An entire change was found necessary or desirable in the persons employed in connection with the water office, and we feel with our present employees, and our new system, there is no danger of a repetition of our recent experience.

It gives us pleasure to commend the assiduity and faithfulness of our present Registrar, and the men employed under him, and also to note the continued interest in our Department by our City Engineer and City Solicitor, to both of whom we are indebted for advice and counsel, which has always been cheerfully rendered.

No large outlay in the extension of the Water-Works is contemplated during the coming year, except what is found necessary in connection with the drainage from the Cushing Street district.

We have two districts where the pipes need to be raised and renewed, which it is proposed to have done. The very low price of pipe and material, and the superabundance of labor, make this a most favorable time to renew pipes where necessary.

We would again state the importance of our having from the Legislature the well-defined authority to take what land may be necessary about the ponds to preserve the purity of the water, the



present act being indefinite, and not clearly meeting our wants or necessities.

The application we made last year for the police jurisdiction of Fresh Pond was refused, it being opposed by Belmont, and thus the importance of having the entire pond included within the City limits was again presented; we think now with proper effort this could be accomplished, and we commend it to your consideration.

At the time that portion of Fresh Pond was dug out near our engine house, a convenient place was needed whereon to deposit the material taken out.

An agreement was made with the Tudor Heirs, by which they agreed to give the strip of land between Lake View Avenue and Fresh Pond to the City, upon the condition that it should be kept forever open as a common, and beautified by setting out trees, shrubs, etc. The low unsightly place along the avenue was graded up by the material from the pond, and the whole presents a comparatively neat appearance, with a full view of our beautiful lake for a long distance.

The soil taken from the pond needs clay or gravel mixed with it to make a greensward, and we would call attention to this matter, that the title of this ground may be secured, and that it may be improved in accordance with the original understanding and agreement. In a few years from now this will be one of the most pleasant drives and places of resort in our city, and at a very small cost all that is necessary can be done.

Whether this work should be turned over to the Committee on Public Property, or done under the direction of the Water Board, remains for you to decide. But we think that trees should be set out, and evidence given by our actions that we mean to carry out our part of the agreement in good faith.

On the 14th of April last our Superintendent, Mr. S. W. Dudley, died suddenly at his desk in the office of the Water Board, early in the morning, literally dying at his post of duty. We all felt that the Board and the City had lost a faithful and valuable servant, and we were much in doubt about finding one who would fill his place.

After looking around carefully, the Board made a unanimous choice of Mr. Hiram Nevons, a man well known to many of our citizens, as Mr. Dudley's successor. He was chosen May 8th, and the result of more than six months' experience leads us to the

conclusion that we have got the right man in the right place. During that time he has made great progress in acquainting himself with the Water-Works in their many details, and the duties appertaining to his office; at the same time the ordinary business of the Water-Works has received prompt attention.

For details of what has been done, and our present condition, we refer you to the reports of the Registrar and Superintendent hereto attached, and submitted as part of our Report.

Respectfully submitted,

GEO. P. CARTER,  
C. W. KINGSLEY,  
H. L. EUSTIS,  
PEREZ G. PORTER,  
FRANK A. ALLEN,  
J. WARREN MERRILL,  
JOHN H. LEIGHTON,

} *Cambridge  
Water Board.*

CAMBRIDGE, Dec. 15, 1877.

# REPORT

OF

## THE WATER REGISTRAR.

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WATER REGISTRAR'S OFFICE,  
CAMBRIDGE, December 10, 1877.

TO THE WATER BOARD:—

THE undersigned herewith presents his Report of the receipts, expenditures, and abatements for the year ending November 30, 1877, together with a statement of the number of water-takers, fixtures, etc., and other matters in his department.

	Receipts.	
Water-rates . . . . .	\$ 129,958.90	
Meter-rates . . . . .	20,292.25	
	<hr/>	\$ 150,251.15
Water-rates for 1875 - 76 . . . . .	3,458.04	
Meter-rates for 1875 - 76 . . . . .	3,698.92	
City rates for 1876 . . . . .	670.00	
	<hr/>	7.826 96
		<hr/>
		\$ 158,078.11
Laying and repairing supplies . . . . .	\$ 6,204.86	
Old material sold . . . . .	626.54	
Off and on water, seals and fines . . . . .	1,360.30	
Rent of house at pipe-yard . . . . .	132.50	
Return insurance premium . . . . .	18.75	
	<hr/>	8,342.95
		<hr/>
Total . . . . .		\$ 166,421.06
All of which sum has been paid to the City Treasurer.		

**Expenditures.**

Care and Repair Account, viz. :—

General repairs . . . . .	\$ 9,520.56
Pumping service . . . . .	7,564.49
Office expenses . . . . .	5,527.39
Water-rates refunded . . . . .	3,234.52
	<hr/>
	\$ 25,846.96
Extension account . . . . .	15,881.98
Supply account . . . . .	4,107.04
	<hr/>
Total . . . . .	\$ 45,835.98

**Abatements.**

Abatements have been made during the year to the amount of . . . . .	\$ 783.04
Water-rates have been refunded, for houses shut off or fixtures sealed, to the amount of . . . . .	\$ 3,234.52

Water has been shut off for non-payment of rates, or per order of owners on account of vacancy, and seals have been applied by request of owners or occupants, as follows :—

Houses shut off in 1877 . . . . .	543
“ let on “ “ . . . . .	381
“ “ “ shut off in 1876 . . . . .	38
Seal-locks applied to fixtures in 1877 . . . . .	1,105
“ removed from fixtures in 1877 . . . . .	358
“ “ put on in 1876 . . . . .	22

Statement of the yearly revenue received from water-rates since the purchase of the works by the City.

From April 28, 1865 to Dec. 1, 1865 . . . . .	\$ 32,367.19
“ Dec. 1, 1865 “ 1866 . . . . .	40,073.27
“ “ 1866 “ 1867 . . . . .	52,733.62
“ “ 1867 “ 1868 . . . . .	63,747.42
“ “ 1868 “ 1869 . . . . .	76,149.30
“ “ 1869 “ 1870 . . . . .	92,606.95
“ “ 1870 “ 1871 . . . . .	111,782.65
“ “ 1871 “ 1872 . . . . .	127,201.30
“ “ 1872 “ 1873 . . . . .	146,117.32



From Dec. 1, 1873, to Dec. 1, 1874	.	.	.	\$ 153,634.27
" " 1874, " 1875	.	.	.	138,880.37
" " 1875, " 1876	.	.	.	179,166.76
" " 1876, " 1877	.	.	\$ 158,078.11	
Less refunds	.	.	3,234.52	
			<hr/>	154,843.59
Water-rates unpaid November 30	.	.	.	\$ 2,471.52
Meter-rates " "	.	.	.	618.79
City-rates " "	.	.	.	4,357.50
Supplies and repairs "	.	.	.	
Charges prior to May 1, 1876	.	.	\$ 7,129.19	
" since May 1, 1876	.	.	1,540.71	
			<hr/>	8,669.90
Total	.	.	.	<hr/> \$ 16,117.71

The usual annual examination of premises has been made, and the office-list of fixtures changed in accordance therewith.

136 new supplies have been laid during the year.

24 meters have been placed in use in various locations during the year, and 11 have been removed.

118 meters are now in use.

(As the Superintendent's Report this year contains a detailed list of meter locations, it is omitted from this Report.)

Besides the manufactories, etc., supplied by meter, water is now supplied to

9 738 Families.

712 Stables.

410 Shops, stores, and offices by the following fixtures, viz :

11,806 Faucets.

3,163 Wash-basins.

1,743 Wash-tubs.

1,705 Bath-tubs.

3,778 Pan-closets.

492 Slop-closets.

23 Hopper closets.

68 Urinals.

79 Yard hydrants.

8 Fountains.

1,051 Hose.

5 Tumbler-washers.

The above is exclusive of the School-houses, Engine-houses, Police Stations, and other City buildings, using the additional number of

76 Faucets.

30 Wash-basins.

4 Bath-tubs.

5 Urinals.

31 Pan-closets.

12 Door-closets.

5 School closets, 114 seats.

4 School urinals, 417 jets.

49 School sinks, 239 jets.

6 Stables.

6 Hose.

1 Steam engine.

582 Fire hydrants.

14 Fire reservoirs.

14 Drinking fountains.

5 Garden hydrants.

Respectfully submitted,

J. WARREN COTTON, *Registrar.*

**REPORT**  
**OF THE**  
**COMMITTEE ON ACCOUNTS OF THE WATER BOARD.**

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CITY OF CAMBRIDGE,  
IN WATER BOARD, Dec. 19, 1877.

THE Committee on Accounts which, at the last meeting of the Board, was authorized to employ an accountant to aid it in examining the accounts of the Water Registrar, begs leave to

**Report:**

That Mr. James A. Holmes was employed for this purpose, and that every book, entry, and voucher of the Registrar has been examined and compared, and that all his books and accounts have been properly kept, are properly vouched, and in all respects correct.

The Committee takes pleasure in commending the neat, exact, and methodical manner in which the books of the Registrar have been kept.

FRANK A. ALLEN, } Committee  
PEREZ G. PORTER, } on Accounts.

**REPORT**  
**OF THE**  
**SUPERINTENDENT OF THE WATER-WORKS.**

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CAMBRIDGE, Dec. 8, 1877.

**TO THE PRESIDENT AND MEMBERS OF THE CAMBRIDGE WATER BOARD.**

GENTLEMEN, — The Annual Report of your Superintendent, required by ordinance, is herein presented.

My predecessor in this office, the late S. W. Dudley, Esq., died suddenly at his desk, April 14, 1877, and I was elected by your Honorable Board to succeed him, May 8, 1877. Without previous acquaintance with the details of his duties or of our extensive system of water-supply, I have made earnest endeavors to acquire a knowledge of the Water-Works and the duties of my office; which, I trust, have been moderately successful.

**Little Pond, Wellington Brook, and Conduit.**

The pipe connection between Spy and Little Ponds has not been used this season. It and its gate are in working condition. Some little labor has been spent on the borders of Little Pond, clearing away objectionable matter, with no material change from its condition subsequent to the extensive labors of previous years.

The "filter-basin" was completed this season by the City Engineer, and now discharges a very considerable quantity of water into the conduit.

The conduit from Little to Fresh Pond is of recent construction, large capacity, and appears to be in perfect order. No examination of the interior has been made or deemed necessary. An additional gate is required at the filter-basin end, to control its water before such examination of that portion is possible. No signs of settling

or other defects are apparent. During the past season provision has been made for ventilation at each manhole by cylindrical covers perforated on the sides. A new manhole has been built near Little Pond.

At Wellington Brook gate-house, a tight wooden flume, 33 feet in length and 4 feet in width, having a gate at its upper end, has been built to secure a clean channel from the brook to the conduit, when water from this source is used. The open channel which before existed received deposits of solid matter from the stream, without means to prevent their discharge into the conduit. The sides of the Wellington Brook channel proper, at its crossing the conduit, have also been faced with sheet-piling for a length of 56 feet, and a gate set at the up-stream end.

Much has been done this year to relieve the brook above the conduit from agencies of contamination on its borders. The most polluting influences have been abated, and others should receive future attention. Its waters should be taken early in the spring or late in the fall. No necessity to use them has yet occurred at any other season.

The conduit has been delivering water into Fresh Pond since October 11, in quantity which, with the natural pond supply, has been more than equal to the demands of pumping.

#### **Fresh Pond.**

No important changes in the surroundings of Fresh Pond have been made this season. The banks in Cambridge and Belmont on the northeast side of the pond, from the grove to west of Black's Nook, have been kept clear from rubbish, the grass trimmed, and cleanliness secured. At Black's Nook the vegetable growth of its water has been removed. All portions of the borders of the pond have been examined and watched, and, in my opinion, no objectionable drainage worthy of serious consideration gets into the pond at present, except from the neighborhood of Cushing Street, Belmont.

#### **Pumping Works.**

The Fresh Pond conduit to the pumps, the pump-wells, and all gates or connections, are in perfect condition so far as can be judged without inspection of the interior. The past season the engineer's house has been enlarged by the addition of an L; a horse-



shed has been built connected with the coal-house; the lawn and grounds about the buildings have been improved; fifty-eight Scotch elms and maples have been purchased and set out by the City Forester; and all the buildings have been painted and put in thorough repair. Railroad connection has been made with the coal-shed in such manner as to reduce the cost of discharging the coal from the cars to one quarter what it was before.

The two Worthington engines, which have been run alternately during the year, have needed but slight repairs, and, with all appendages, appear to be in perfect condition, and are so reported to me by the engineer in charge, Mr. E. C. Brooks, whose character in the line of his duty may be best estimated by a visit to the pumping-works and an inspection of the machinery there under his control.

The pumping mains, 24-inch and 30-inch from engines to reservoirs, have received no repairs and have shown no signs of leakage during the year.

#### Reservoirs.

The stand-pipe is in perfect order, with no change but painting the outside wood-work.

Both reservoirs have been drawn off separately and thoroughly cleaned. The larger exhibited no interior defects except some small crevices in the paving-joints and slight settling of the coping-stones at the northwest corner, with open joints. Crevices and joints were cemented or grouted. The smaller reservoir showed three sides in perfect condition, but, at the partition between the two, leakage from the larger occurred through cracks of considerable size, and there was some bulging of the pavement lining near the bottom. The top showed no settlement. No effort was made to repair the partition, as being too extended a labor for the time and circumstances; but this defective condition needs early attention to retain the power of using either reservoir separately.

The capping of the west retaining-wall had become displaced by frost, and in many places was not in contact with the earth the wall retains. No settlement of the wall appears, or indications of leakage, but portions south of the northwest corner have bulged slightly, with no appearance of recent change. South of the stand-pipe small portions were rebuilt in cement with grouting at the back, and all the capping was relaid in a similar manner. The

north and south walls were pointed, and all were whitewashed. North of the stand-pipe nothing was done to the wall proper, but I regard it as a matter for consideration whether portions should not be strengthened or rebuilt.

The low wall on the east side of the north reservoir needs repairing in the spring. The banks have required some little rebuilding, and have been kept in good order, the grass trimmed, and the walks cleaned.

#### **Distribution Pipes.**

The larger iron main pipes have needed only slight repairs, and no extensions of larger size than 8-inch have been made.

Water has been carried to the Cambridge Cemetery through Coolidge Avenue, and distributed to different points in the grounds. New pipe, with necessary connections of supplies, has been laid within the "Franklin Street District," in Franklin, Bay, Kinnsaid, Hancock, and Soden Streets, and within the "Sparks Street District," in Willard, Foster, Brown, Sparks, and Mt. Auburn Streets, and Burns, Dinsmore, and Marsh Courts; in both cases a necessity resulting from the low-land filling in these districts. In Tremont Street, from Broadway to Hampshire, new and larger pipe has replaced the old. In Potter Street, west of Sixth, an 8-inch pipe has been carried to the large factory of the Eagle Rubber Co. In Buckingham, Fifth, Winter, Chauncy, Erie, and other streets, new 6-inch pipe has been laid. The total length of mains, of all sizes, put down this year has been about two and three quarter miles, details being given in the tables appended to this Report.

The repairs have been chiefly on small pipe, and although the aggregate of labor and stock is considerable, no single job has been large.

The mains have been cleared by a large amount of blowing off in August and September, in addition to the ordinary use of hydrants for this purpose.

In the "Cambridge Street District" the condition is unsatisfactory. Extensive renewals are required, and probably important changes must be made in the "Cowperthwaite Street District." In both sections extra watchfulness has been exercised to guard against the results of settling.

The 10-inch cement pipe on North Avenue, south of the Fitchburg Railroad, has required repairs in several places. Should it be



changed for an iron pipe, with a renewal of the former connection across the bridge at "Porter's Station," the territory north of the railroad would secure a duplicate means of supply, and a greater abundance of water for fire hydrants.

An inspection of all gates has been made, several new ones have been set in place of old, and all put in perfect condition. On extensions this season thirty gates have been used.

#### **Supply-Pipes.**

One hundred and thirty-six new service-pipes have been laid the past year, a little more than half as many as during the preceding. The total number at this date is 6,956. Calls are frequent for repairs, particularly in the low-land districts, where the service-pipes have suffered from the operations of filling. Two districts this year have been put in good order, and two remain in bad condition. All new supplies are provided with sidewalk stand-pipe and shut-offs, and laid in the most thorough manner with the best galvanized iron pipe and brass fitting. Unremitting efforts to detect leaks from service-pipes have been made, and immediate repairs have followed when any have been found. The condition of pipes in some such cases leads to the conclusion that galvanized iron cannot resist the action of some soils.

#### **Hydrants, Meters, Fountains, and Stand-Pipes.**

Twelve new post hydrants have been set in new locations, selected by the Chief Engineer of the Fire Department, and sixteen others have been substituted for flush hydrants in old locations. All these have been the Pattee and Perkins 5-inch hydrants. The total present number of fire hydrants is 575, of which 226 are post and 349 flush hydrants. Eight new garden hydrants have been set, which added to the number reported last year makes a total of 101.

One hundred and eighteen meters, mostly of the Worthington pattern, 14 drinking-fountains, and 36 stand-pipes for street watering are now in use, located as stated on the accompanying lists. All are in good order.

#### **Pipe-Yard.**

At the pipe-yard on Auburn Street good drainage has been secured by building a cesspool and laying 6-inch drain-pipe to the sewer in Brookline Street, an important benefit to the dwelling-house

occupied by the teamster. The fences have been thoroughly repaired, accumulations of old iron disposed of, the yard graded, and a generally improved appearance obtained.

The following tables show the monthly amount and daily average of water pumped, the Fresh Pond record of water height, the locations of meters, fountains, and stand-pipes, the details of main and supply extensions, and the account of stock on hand.

All which is respectfully submitted,

HIRAM NEVONS,  
*Superintendent.*

## APPENDIX.

### Engine Record.

The Amounts of Water pumped being computed from Engine Revolutions.

IN THE MONTH OF	RUNNING TIME,		Coal Used.	MONTHLY TOTALS	DAILY AVERAGE
	Hours.	Minutes.		Gallons Pumped	Gallons Pumped
December, 1876 .	366	30	168,600 lbs	89,828,100	2,897,681
January, 1877 .	408	35	178,700 "	97,854,900	3,156,609
February, " .	329	40	145,700 "	75,272,700	2,688,311
March, " .	334	20	151,400 "	75,559,200	2,487,393
April, " .	299	05	181,000 "	70,390,200	2,346,340
May, " .	334	15	138,600 "	81,314,700	2,623,055
June, " .	374	20	149,300 "	91,727,700	3,057,590
July, " .	352	40	143,500 "	81,569,100	2,631,261
August, " .	338	00	142,600 "	78,015,000	2,616,613
September, " .	340	55	141,200 "	78,799,500	2,626,650
October, " .	328	40	139,500 "	73,993,800	2,386,897
November, " .	296	10	125,800 "	66,257,400	2,208,580
Totals . . . . .	4,103	10	1,750,900 lbs.	960,582,300	
Daily Aver. for Year	11	14½	4,797 lbs.		2,631,732

### Fresh Pond Record.

	Feet.
Average height of water surface during December, 1876 . . . . .	12.30
" " " " " January, 1877 . . . . .	12.37
" " " " " February, " . . . . .	12.65
" " " " " March, " . . . . .	14.84
" " " " " April, " . . . . .	16.16
" " " " " May, " . . . . .	15.88
" " " " " June, " . . . . .	15.14
" " " " " July, " . . . . .	14.17
" " " " " August, " . . . . .	13.84
" " " " " September, " . . . . .	12.55
" " " " " October, " . . . . .	12.33
" " " " " November, " . . . . .	12.98
Average of preceding heights . . . . .	13.73
Highest water observed (high water) is . . . . .	16.85

### List of Meters in use November 30, 1877.

	Locality.	Size.	Description.
American Net and Twine Company	Third Street	1½	Worthington
Atkins, Henry . . . . .	North Avenue	½	Harris
Blake Hose Association . . . . .	Broadway	¾	Worthington
Boston & Albany Railroad Company	Putnam Avenue	1½	"
Boston Car-Wheel Company . . . . .	Hampshire Street	¾	"
Boston Chemical Works . . . . .	Third Street	¾	"

	Locality.	Size	Description.
Boston & Lowell Railroad Company	Repair-shop	in. 2	Worthington
" " " "	Old Round House	2	"
" " " "	New Round Ho.	2	"
" " " "	Paint-shop	1	"
Boston Rolling-Mill . . . .	Portland Street	2	"
Boynton Packing Company . .	Winsor Street	1½	"
Brown & Nichols . . . .	Brighton Street	1	"
Bullock, O. S. . . . .	Broadway	1	"
Cambridge Gas-Light Company .	Third Street	2	"
Carr Brothers . . . . .	Lopez Street	1	"
City of Cambridge . . . .	Alms-house	2	"
" " . . . . .	Brattle Square	2	"
" " . . . . .	Cemetery	4	"
" " . . . . .	Green Street	2	Ball & Fitz
Clark, B. P. & Co. . . . .	Main Street	1½	Worthington
Clark, H. M. . . . .	North Avenue	½	"
Cofran, S. M. . . . .	Vassal Lane	2	"
Coolidge, Joseph G. . . . .	Coolidge Avenue	1	"
Cox, Leonard . . . . .	Soden Street	1	"
Dailey, William . . . . .	Cambridge Street	1	"
Davis, Curtis . . . . .	Broadway	1½	"
Davis, J. C. & Son . . . .	"	1	"
Dover Stamping Company . .	Pleasant Street	4	"
" " " " . . . . .	Engine	1	"
Draper, F. & Co. . . . .	Otis Street	4	"
Dunham, George A. & Co. . .	Thorndike Street	1	"
Eagle Rubber Company . . .	Potter Street	2	"
Fitchburg Railroad Company .	Dublin Street	2	"
French, C. A. . . . .	Farwell Place	1	"
Geldowsky, F. . . . .	Otis Street	1	"
Griffin & Dolan . . . . .	Decatur Street	4	"
Hale, Teele, & Bisbee . . . .	Davis Street	1	"
Hancock & Greely . . . . .	Broadway	1½	"
Harvard College . . . . .	Botanic Garden	1	"
" " . . . . .	Boylston Hall	1	"
" " . . . . .	Cambridge Street	2	"
" " . . . . .	Flagg Street	4	Ball & Fitz
" " . . . . .	Holworthy Hall	4	Worthington
" " . . . . .	Holyoke House	2	"
" " . . . . .	Stoughton Hall	1	Boston Ma-
" " . . . . .	Thayer Hall	1½	chine Co
" " . . . . .	Yard	1½	Worthington
Harvard Laundry . . . . .	Douglass Street	4	Ball & Fitz
Hewes, A. H. & Co. . . . .	Crescent Avenue	1½	Worthington
Hixon, Edward . . . . .	Harvard Street	4	"
Houghton, H. O. & Co. . . .	Blackstone Street	1	"
" " " " . . . . .	Fountain	4	"
Jaynes & Co. . . . .	Pacific Street	4	"
Jones, C. L. & Co. . . . .	Pearl Street	4	"
Kennedy, F. A. . . . .	Green Street	1	"
Lewis, F. H. . . . .	Broadway	1	"
Little, Brown, & Co. . . . .	Blackstone Street	1	"
Lowe, E. D. . . . .	Portland Street	4	"
Lowe, J. W. . . . .	Reed Street	1½	"
Mason & Hamlin Organ Company	Broadway	1	"
" " " " . . . . .	"	1	"

	Locality.	Size.	Description.
Mason & Hamlin Organ Company	Broadway	$\frac{1}{2}$	Worthington
Middlesex Bleachery	Sacramento St.	$\frac{1}{2}$	"
Middlesex County Ho. of Correction	Thorndike Street	2	"
Moering, Mrs.	Main Street	$1\frac{1}{2}$	"
Moulton, C. W. H.	Gore Street	$\frac{1}{2}$	"
Mount Auburn Corporation	Mt. Auburn St.	1	"
" " "	"	$1\frac{1}{2}$	"
Murdock, Robert	Hews Street	$\frac{1}{2}$	Ball & Fitz
New England Brick Company	Raymond Street	$1\frac{1}{2}$	Worthington
New England Glass Company	North Street	2	"
Page, George G. & Co.	Hampshire Street	2	"
Pike, James & Co.	Church Street	1	"
" " "	Farwell Place	$\frac{1}{4}$	"
Pratt, D. G.	Broadway	1	"
Reardon, John & Son	Pearl Street	■	"
" " "	Butter-factory	1	Ball & Fitz
Revere Sugar Refinery	Water Street	3	Rot'ry Piston
" " "	" "	3	Worthington
Reversible Collar Company	Arrow Street	1	"
Rhoades, Silas & Co.	State Street	2	"
Rogers, G. M.	Washington St.	3	"
St. Mary's School	Harvard Street	$\frac{1}{2}$	"
Sands, J. L.	Walden Street	1	"
Shaw & Applin	Bridge Street	$1\frac{1}{2}$	"
Sortwell & Co.	Distillhouse St.	2	"
Squire, J. P. & Co.	Gore Street	2	"
" " "	" "	2	"
" " "	Stable	1	"
Standard Ammonia Company	Potter Street	$\frac{1}{2}$	"
Stiles, J. C. & Co.	Winter Street	1	"
Thayer, Henry & Co.	Broadway	■	"
Thorndike, E.	Main Street	$\frac{1}{2}$	Ball & Fitz
Tower, Sylvester	Broadway	1	Worthington
Tug "Henry Chapel,"		2	"
Uhrig, Joseph	Main Street	$1\frac{1}{2}$	"
Union Glass Company	Packing-room	1	"
" " "	Pot-house	1	"
Union Railway Co.	Baldwin Street	1	"
" " " Car-house	" "	1	"
" " "	Cambridge Street	$1\frac{1}{2}$	"
" " " Brick Stable	Dunster Street	$1\frac{1}{2}$	"
" " " Engine	" "	$\frac{1}{2}$	"
" " " New Car-house	" "	1	"
" " " Washing cars	" "	$\frac{1}{2}$	"
" " " Wood-stable	" "	$\frac{1}{2}$	"
" " "	Main Street	1	"
" " "	Mt. Auburn St.	2	"
" " "	North Avenue	2	"
" " "	River Street	1	"
Walworth Manufacturing Company	Main Street	$1\frac{1}{2}$	"
Welch, Bigelow, & Co.	Brattle Street	$\frac{1}{2}$	Ball & Fitz
Wilson, John & Son	Holyoke Street	■	Worthington
Woodbury	Green Street	1	"
Woodbury & Co.	Otis Street	2	"
Woods, George & Co.	Main Street	2	"
Wyeth, H. M.	Dublin Street	1	"



**List of Drinking-Fountains, November 30, 1877.**

Bridge Street, at junction Cambridge Street.  
Broadway, at southwest corner of Norfolk Street.  
Brattle Square, east side, at Brewer's Block.  
Cambridge Common, north of Soldier's Monument.  
Cambridge Street, at southwest corner of Fifth Street.  
Central Square, west side, at D. U. Chamberlin & Co.'s store.  
Fort Washington.  
Hampshire Street, at junction Broadway.  
Inman Square, east side.  
Main Street, at junction Front Street.  
North Avenue, at southwest corner of Walden Street.  
North Avenue, north side, west of Cameron Street.  
Putnam Avenue, at southwest corner of Pearl Street.  
Third Street, west side, north of Main Street.

**List of Stand-pipes (for Street Watering), November 30, 1877.**

Brattle Street, near University Press.  
Brattle Street, at corner of Sparks Street.  
Brattle Street, near Fayerweather Street.  
Brattle Street, near Fresh Pond Lane.  
Bridge Street, at junction Cambridge Street.  
Broadway, near Third Street.  
Broadway, at corner of Sixth Street.  
Broadway, at corner of Winsor Street.  
Broadway, at junction Hampshire Street.  
Brookline Street, at corner of Putnam Avenue.  
Cambridge Street, near Warren Street.  
Cambridge Street, near Winsor Street.  
Cambridge Street, at Inman Square.  
Columbia Street, near Austin Street.  
Concord Avenue, at junction Garden Street.  
Dana Street, at Corner of Chatham Street.  
Dublin Street, near Fitchburg Railroad.  
Fifth Street, near Thorndike Street.  
Gore Street, west of Third Street.  
Green Street, near Western Avenue.  
Harvard Street, at corner of Prescott Street.







## New Supplies.

Galvanized pipe and brass fittings used Dec. 1, 1876, to Nov. 30, 1877, inclusive.

	4 in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	Totals.
Length galv. iron pipe .	17½ ft.	136 ft.	200 ft.	615 ft.	5,274 ft.	..	6,242½ ft.
Supplies . . . . .	* 2	2	4	1	127	..	136
Stop and waste . . . .	..	2	4	4	129	..	139
Screw-cocks . . . . .	..	1	4	3	120	..	128
Sidewalk cocks . . . .	..	1	4	2	125	..	132
Corporation cocks . . .	..	..	..	1	6	..	7
Gates . . . . .	1	..	..	..	..	..	1
Faucets . . . . .	..	..	..	..	..	7	7
Ludley valve . . . . .	1	..	..	..	..	..	1

The above number of new supplies added to the total number reported last year (6,820) gives the present total of supplies as 6,956.

## Statement of Stock on Hand December 1, 1877.

For street mains (iron pipe and fittings).

Number of	48 in.	30 in.	24 in.	20 in.	18 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3 in.
Straight pipes (12 feet each)	2	23	25	17	4	25	166	122	12	9	
Elbows . . . . .	..	1	1	..	..	..	1	..	16	..	
Bends . . . . .	..	1	2	1	1	..	16	..	..	..	
Y branches . . . . .	..	..	1	..	..	1	..	..	..	..	
Sleeves . . . . .	..	2	8	9	5	3	4	9	5	..	2
Clamp-sleeves . . . . .	..	..	6	..	..	3	7	9	1	2	1
Offsets . . . . .	..	..	..	..	..	..	6	..	17	3	
Drain offsets . . . . .	..	..	..	..	..	..	..	..	24	..	
Gates . . . . .	..	..	..	..	..	1	1	2	..	1	
Hydrants (Pathe & Perkins)	..	..	..	..	..	..	..	..	3	(5 in.)	
Check valves (old) . . . .	..	..	2	..	..	..	..	..	..	..	
				1 20"	1 12"	1-12" 2-10"	2-10" 2 8"	2-8" 8-6"	13-4"		
Crosses . . . . .	..	..	..	..	..	4-8"	4-6"	4-4"	8-4"		
			1-10"	..	..	4-4"	4-6"	4-4"	8-4"		
		1-24"	1-12"	5-6"	1-12"	25-6"	9-6"	4-4"	22 4"		
Tees . . . . .	..	1 8"	1-10"	..	1-8"	5-6"	..	..	..		
		2-6"	1-12"	..	1-8"	..	..	..	..		
Reducers . . . . .	..	1-12"	1 10"	..	1-6"	6-6"	7-6"	3-4"	1-3"		
		1-10"	1-8"	..	..	..	..	..	..		
Blow-off . . . . .	..	..	2 6"	..	..	..	..	..	..		
Caps . . . . .	..	..	..	2	..	8	1	6	6	6	
Plugs . . . . .	..	..	..	..	..	..	..	2	1		

3,008 lbs. lead, 47 lbs. packing, 1 bbl. Roman cement, 4 hydrant boxes, 3 gate boxes.

\* One of these supplies is that to the Cambridge Cemetery Grounds, of which the length of cast iron pipe laid, and the gates, are included in the preceding table of main-pipe used. The one-inch galvanized pipe and fittings laid at the Cemetery are included in this table, as is also 85 feet of one inch galvanized pipe used for renewal of a supply with larger pipe, which renewal is not counted in the number of new supplies.

For supplies (galvanized pipe and brass fittings).

	2 in.	1½ in.	1½ in.	1 in.	¾ in.	½ in.
Length of galv. iron pipe	96 ft.	170 ft.	675 ft.	375 ft.	870 ft.	56 ft.
Elbows . . . . .	...	30	25	30	143 - ¾"	45
Street elbows . . . . .	...	...	...	30	94 - ¾"	...
Couplings . . . . .	110	150 - ¾"	61	118	130	30
Unions . . . . .	...	9	40	...	5 - ½"	...
Unions for lead pipe	...	...	...	...	57	...
	...	...	...	...	12	...
Crosses . . . . .	25 - 1½"	30 - 1½"	20 - 1½"	8 - 1"	...	...
	...	15 - 1"	16 - 1"	...	...	...
	20 - 1"	21 - ¾"	2 - ¾"	1 - ¾"	...	...
	35 - 2"	12 - 1½"	30 - 1½"	...	199 - ¾"	...
T . . . . .	40 - 1½"	...	15 - 1"	...	...	...
	12 - 1"	20 - 1½"	8 - ¾"	20 - 1"	134 - ½"	20 - ½"
Stopcocks . . . . .	2	1	...	...	...	...
Stop and waste cocks . . . . .	...	...	...	25	80	...
Screw-cocks . . . . .	...	...	...	15	49	...
Sidewalk cocks . . . . .	...	...	...	70	71	...
Corporation cocks . . . . .	...	5	...	...	7	...
Blow-off cocks . . . . .	...	2	...	...	...	...
Hydrant cocks . . . . .	...	...	...	2	1	...
Sill-cocks . . . . .	...	...	...	...	3	...
Cement pipe cocks . . . . .	...	...	...	61	...	...
Hose-bibbs . . . . .	...	...	...	18	...	1
Compression bibbs . . . . .	...	...	...	...	7	...
Air-chambers . . . . .	...	...	...	46	77	65
Socket-ends . . . . .	...	...	...	...	171	...
Lock-nuts . . . . .	...	...	...	36	23	20
Nipples . . . . .	...	...	56	...	...	150
Hose-nipples . . . . .	...	...	...	...	10	...
Plugs . . . . .	3	20	5	35	1	...
Clips . . . . .	...	...	...	25	75	10
Bushings . . . . .	4 - 1"	...	...	...	...	...
Meters . . . . .	2	...	...	...	1	...

3 garden hydrants, 12 gate-spindles, 9 sidewalk stand-pipes. At pumping works: 850 tons of coal, tools in charge of engineer for machinist's repairs. At stable: 2 horses, 3 sets of harness, 4 wagons, 1 pung, 2 hand-carts, 1 hay-cutter. Tools in good condition: 1 large boom-derrick, 2 small derricks, 2 tool-chests, 62 picks, 156 shovels, 2 paving-rammers, 4 iron bars, 4 chains, 12 lanterns, 1 drilling-machine, one thread-cutting machine, 1 large hand-pump, 10 wheelbarrows, 1 platform scale, one grindstone, small tools for laying main and supply pipes.

# REPORT

## OF THE

### TRUSTEES OF THE SINKING-FUND OF THE CAM- BRIDGE WATER-WORKS.

---

THE undersigned, Trustees of the Sinking-Fund of the Cambridge Water-Works, respectfully submit the following Report : —

Amount of Fund, June 30, 1876 . . . . .		\$ 177,138.83 .
Received of the City, under an Ordinance passed Oct. 4, 1876, an amount equal to three per cent on outstanding Water Loan Bonds . . . . .	\$ 45,000.00	
Received accrued interest on bonds sold . . . . .	1,281.67	
Received interest on Fund . . . . .	9,313.63	
	<hr/>	\$ 55,595.30
Amount of Fund, June 30, 1877 . . . . .	\$ 232,734.13	
Interest on Fund, accrued but not due . . . . .	3,682.50	
	<hr/>	
Value of Fund, June 30, 1877 . . . . .		\$ 236,416.63

It has been the custom of the Trustees heretofore to state the value of this Fund up to June 30 only of each year. In order to show its value at the close of the financial year, November 30, to which date all other accounts are made up, we present the following exhibit : —

Amount of Fund, June 30, as above . . . . .	\$ 232,734.13	
Received interest on Fund to Nov. 30 . . . . .	6,347.15	
	<hr/>	\$ 239,081.28



Amount brought forward . . . . .	\$ 239,081.28
Less amount paid for accrued interest on bonds purchased for investment . . . . .	930.66
Amount of Fund, November 30, 1877 . . . . .	\$ 238,150.62
Accrued interest on Fund . . . . .	3,676.66
Value of Fund, November 30, 1877 . . . . .	\$ 241,827.28

The Fund is invested as follows : —

Cambridge Water Bonds, bearing six per cent interest, par value \$ 193,300.00, cost . . . . .	\$ 197,218.75
City of Providence, five per cent bonds payable September 1, 1882, par value \$ 40,000, cost . . . . .	40,800.00
Cash on hand . . . . .	131.87
	<hr/> \$ 238,150.62

The "value" of the Fund, as represented above, includes the sum of \$ 4,718.75, paid as premium above par on bonds purchased by the Trustees as an investment. The Cambridge Water Bonds have all been punched, making them non-negotiable, and no more than their par value can be realized from them. The premium on the other bonds purchased will also be absorbed if they are held for investment, as they are likely to be, until they mature. Deducting the amount paid for premiums leaves the real value of the Fund at par, November 30, 1877, \$ 237,108.53.

FRANK A. ALLEN,	} Trustees.
PEREZ G. PORTER,	
JOS. WHITNEY,	



# CAMBRIDGE WATER BOARD.

1878.

---

GEORGE P. CARTER . . . . . *President.*

## MEMBERS OF BOARD.

THE MAYOR,					
PRESIDENT OF COMMON COUNCIL,					
CHESTER W. KINGSLEY,	<i>term expires</i>	.	.	.	1882.
J. WARREN MERRILL,	" "	.	.	.	1881..
GEORGE P. CARTER,	" "	.	.	.	1879.
HENRY L. EUSTIS,	" "	.	.	.	1878.
JOHN H. LEIGHTON,	" "	.	.	.	1880.

JUSTIN A. JACOBS, *Clerk.*

---

J. WARREN COTTON, *Water Registrar.*  
HIRAM NEVONS, *Superintendent of Works.*

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## TRUSTEES OF SINKING-FUND OF WATER LOAN.

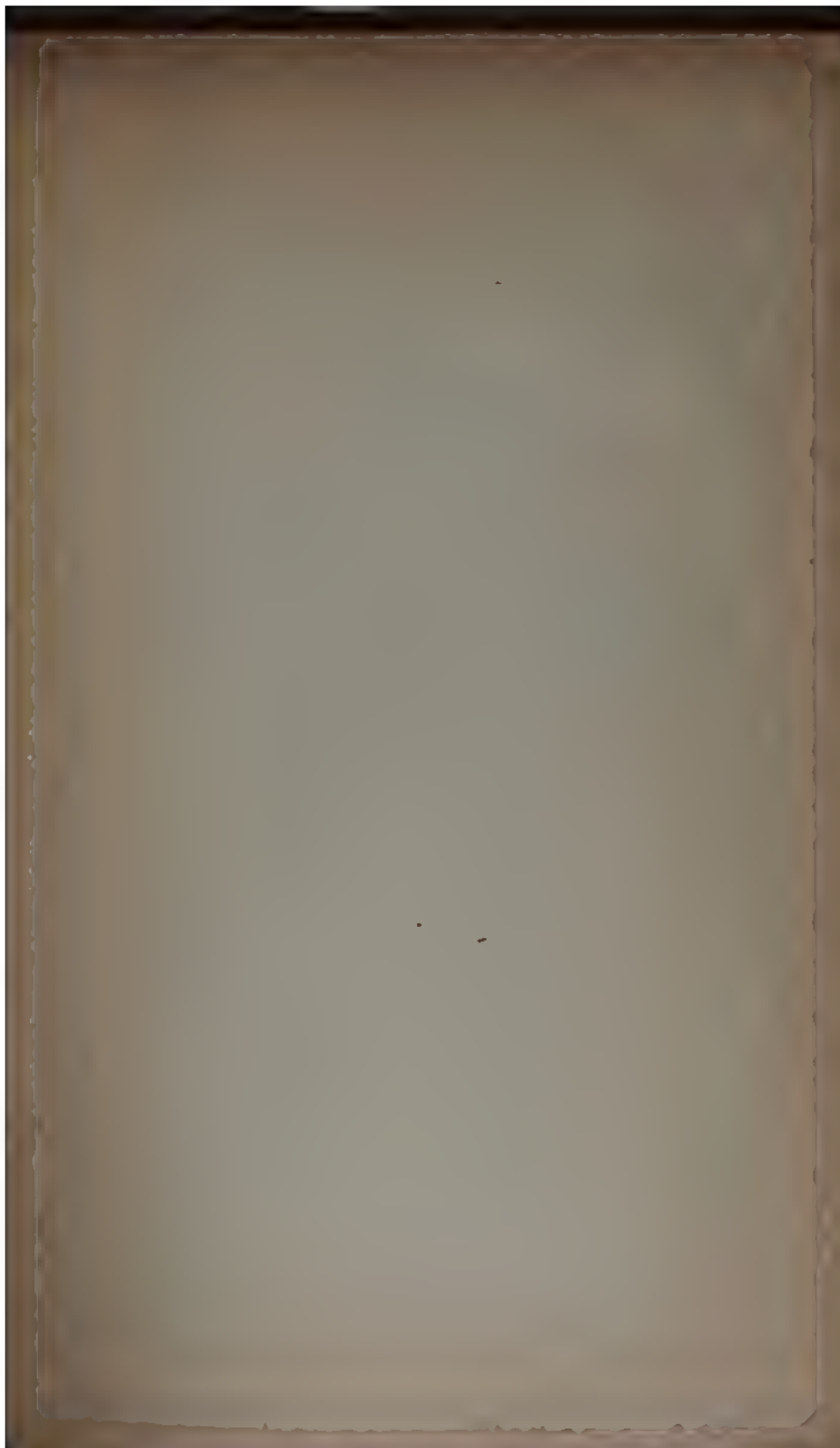
THE MAYOR,					
CITY TREASURER,					
PRESIDENT OF COMMON COUNCIL,					

*ex officio.*



















**This book is under no circumstances to be taken from the Building**

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